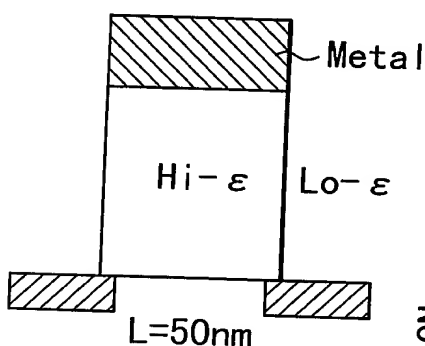


FIG. 1B

- GATE INSULATION FILM LEAKAGE (LIMIT DOWN TO  $T_{ox}=3.0nm$ )  
TUNNELING → DIRECT TUNNELING
- SHORT CHANNEL EFFECT IS REMARKABLE.

FIG. 1A (PRIOR ART)



	$T_{ef}=1.5nm$	$T_{ef}=3.0nm$
TiO <sub>2</sub>	30nm	60nm
SrTiO <sub>3</sub>	75nm	150nm
BST	110nm	220nm

AR=0.6~4.4

HIGH DIELECTRIC  
SUBSTANCE INSULATION  
FILM  
IN THE EFFECT OXIDE  
FILM CONVERSION

LARGE LEAKAGE CURRENT  
LOW INSULATION BREAK-  
DOWN VOLTAGE

HARD TO MAKE  
FILM THIN.

ELECTRIC FIELD WHERE INSULATION  
DESTRUCTION OCCURS (MV/cm)

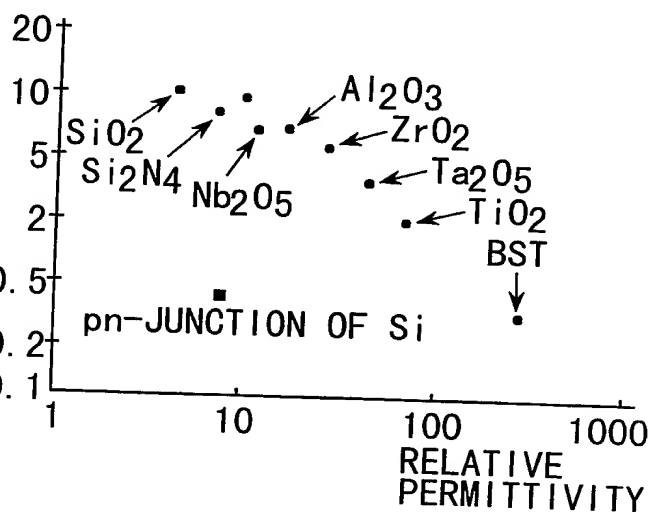


FIG. 2 (PRIOR ART)

APPROVED	O.G. FIG.	
BY	CLASS	SUBCLASS
DRAFTSMAN		

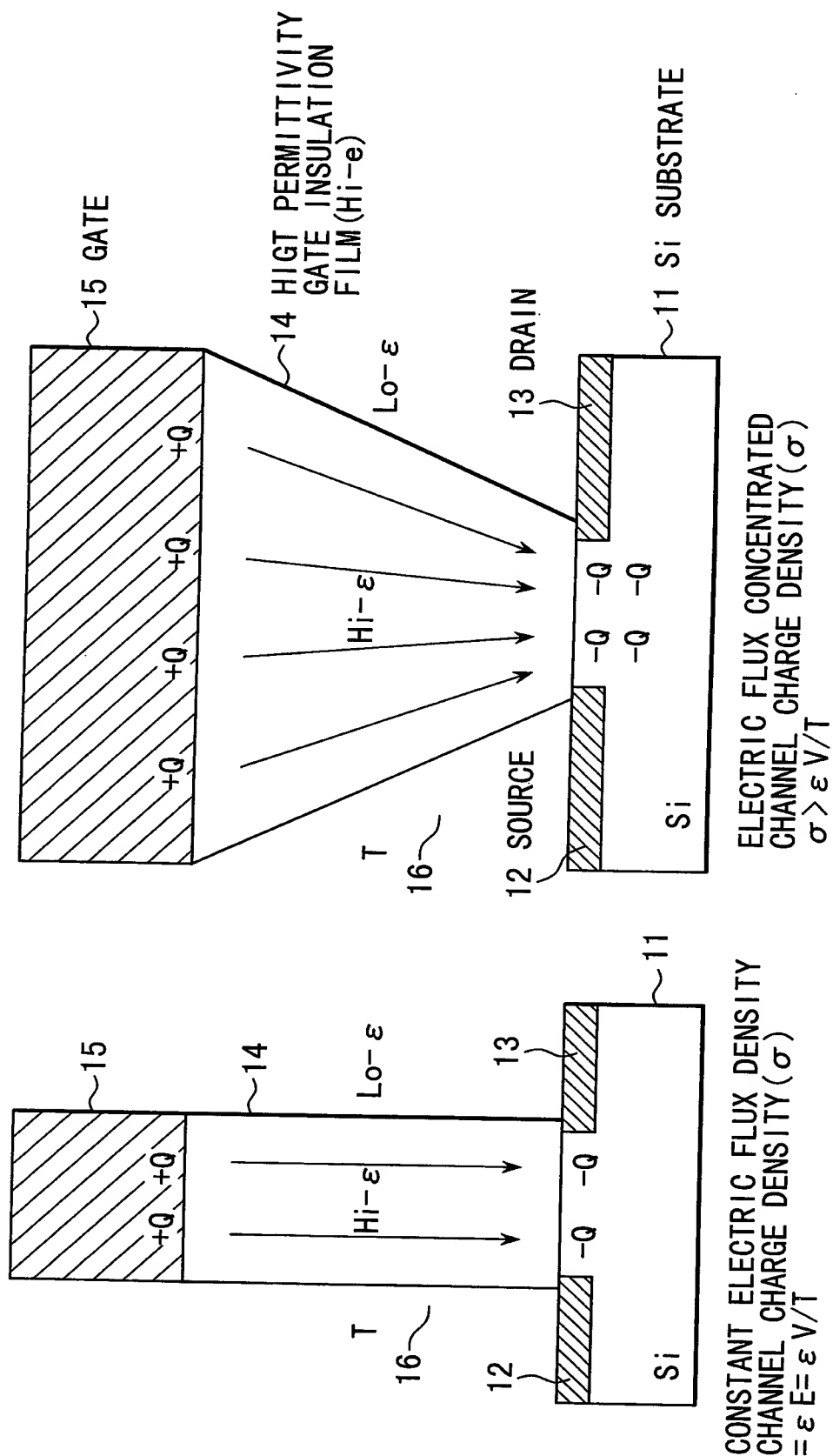


FIG. 3A (PRIOR ART)

FIG. 3B

CHANNEL  
CHARGE  
DENSITY

$$\sigma = \epsilon \frac{V}{T}$$

$$\sigma = \epsilon \frac{V}{T} \left( \frac{\frac{LT}{LB} - 1}{\ln\left(\frac{LT}{LB}\right)} \right)$$

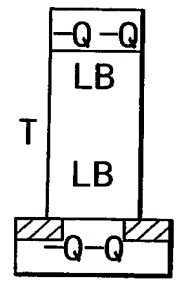
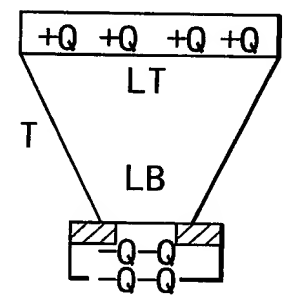
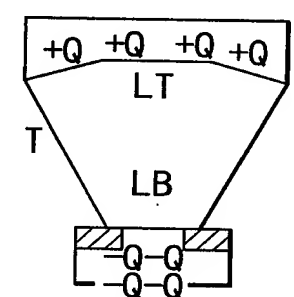


FIG. 4A  
(PRIOR ART)



TRAPEZOID

FIG. 4B



SECTOR

FIG. 4C

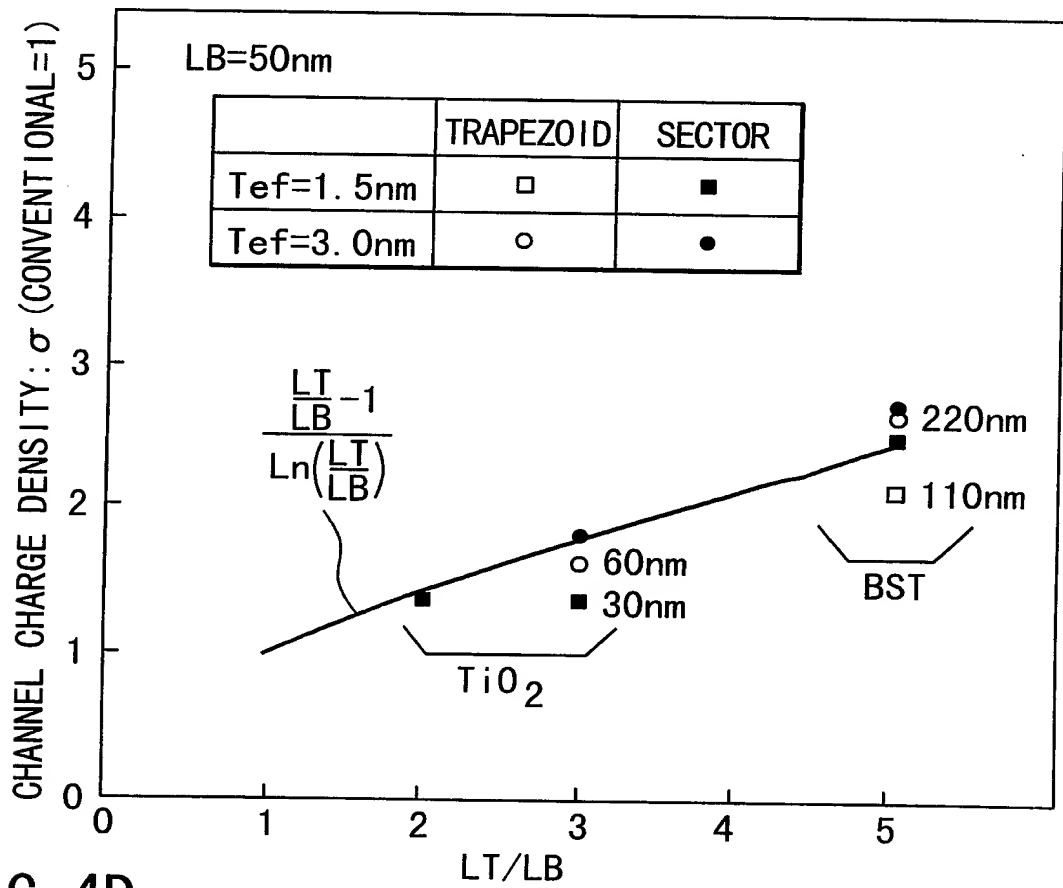
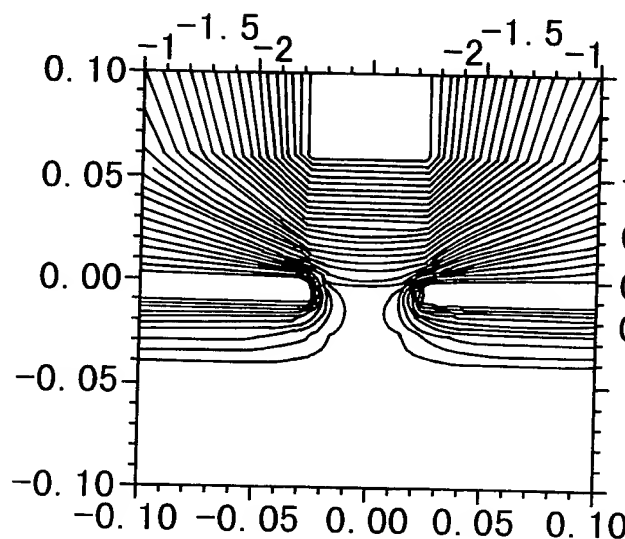


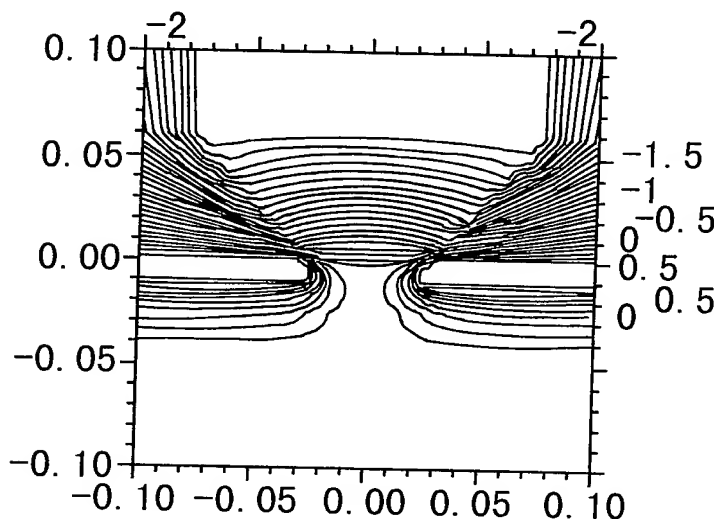
FIG. 4D

APPROVED	O.G. FIG.	
BY	CLASS	SUBCLASS
DRAFTSMAN		



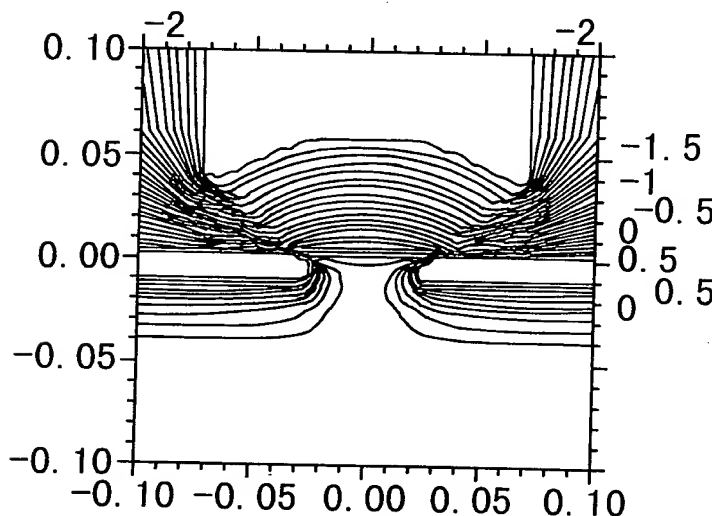
CONVENTIONAL (LT/LB=1)  
 $C_{gb}=0.47\text{fF}/\mu\text{m}$   
 (1.00 TIMES)  
 (PARALLEL-MONOTONOUS  
 APPROXIMATION  
 $=0.59\text{fF}/\mu\text{m}$ )

FIG. 5A  
 (PRIOR ART)



TRAPEZOID (LT/LB=3)  
 $C_{gb}=0.79\text{fF}/\mu\text{m}$   
 (1.67 TIMES)

FIG. 5B

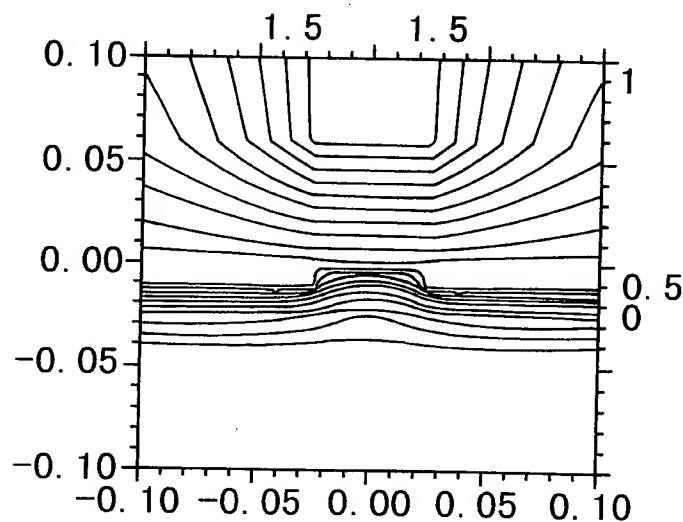


SECTOR (LT/LB=3)  
 $C_{gb}=0.86\text{fF}/\mu\text{m}$   
 (1.83 TIMES)

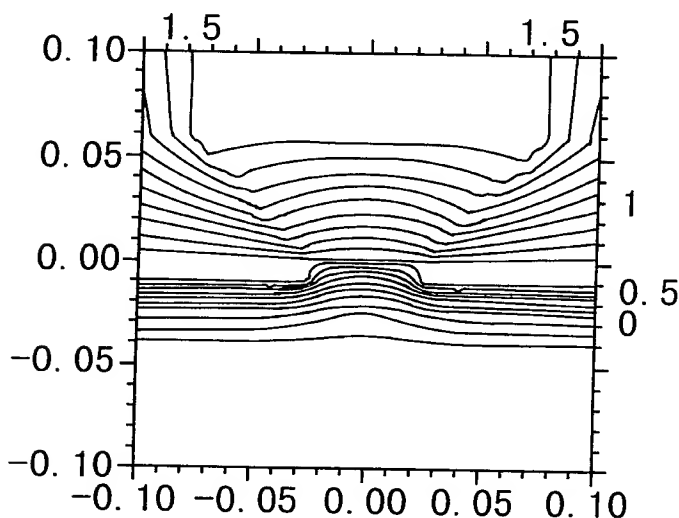
FIG. 5C

EQUIPOTENTIAL LINE CHART  
 ( $V_g=-3\text{V}$ )  $V_d=V_s=V_b=0\text{V}$ , 0.1V/div  
 ( $T=60\text{nm}$ , ( $T_{ef}=3\text{nm}$ ),  $LB=50\text{nm}$ ,  $\epsilon_r=80(\text{TiO}_2)$ )

APPROVED	O.G. FIG.	
BY	CLASS	SUBCLASS
DRAFTSMAN		

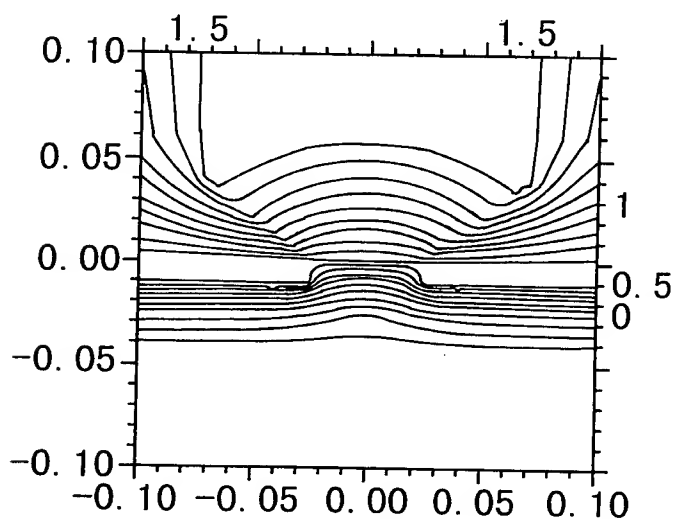


(LT/LB=1)

FIG. 6A  
(PRIOR ART)

TRAPEZOID (LT/LB=3)

FIG. 6B

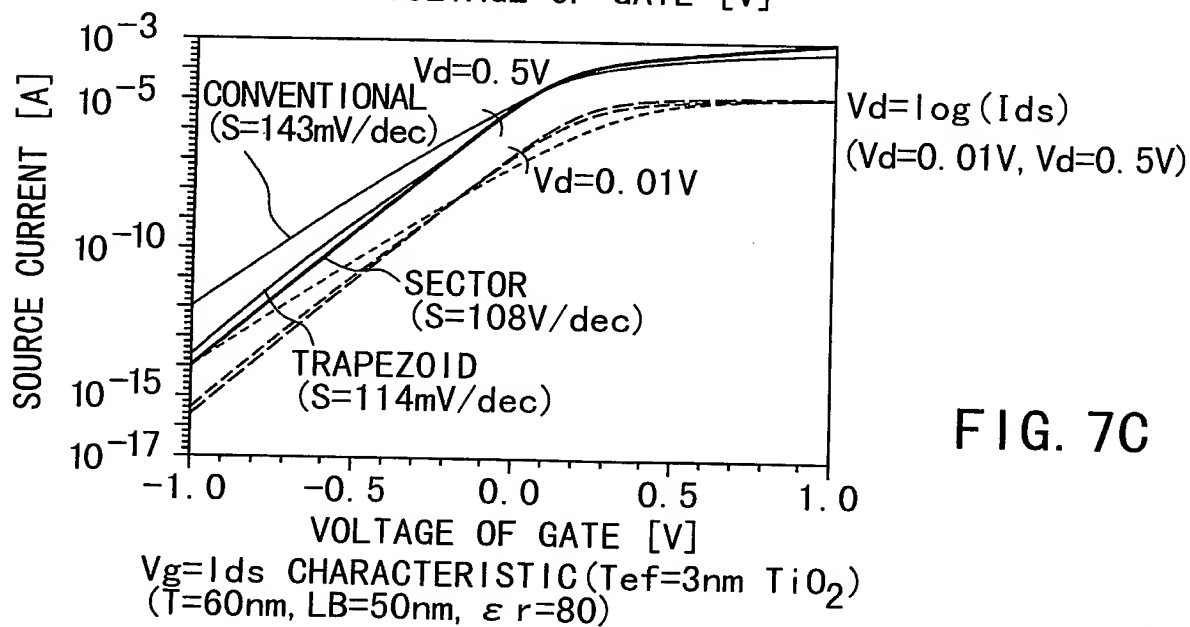
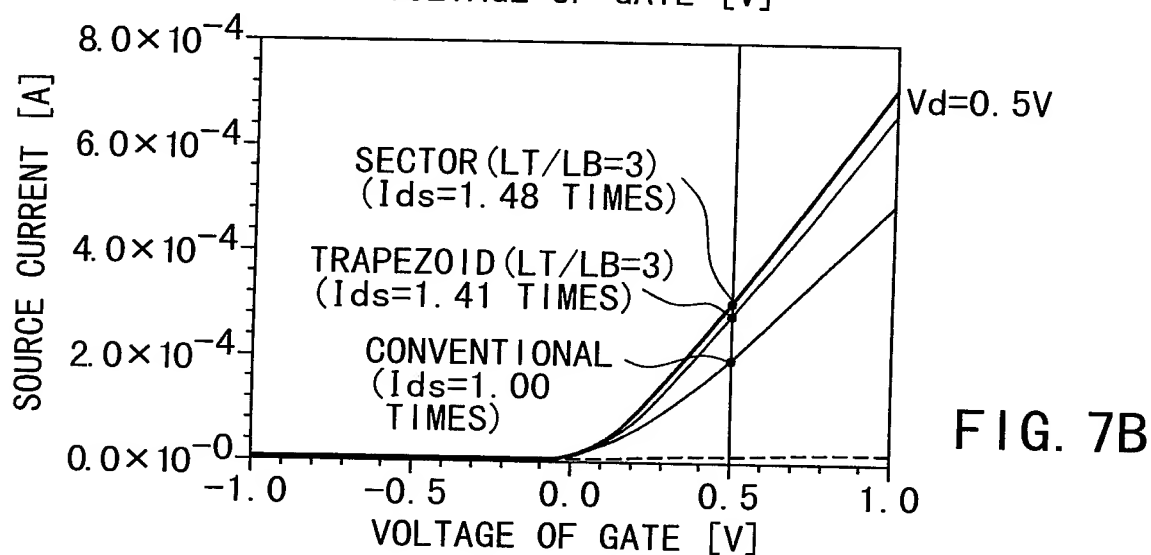
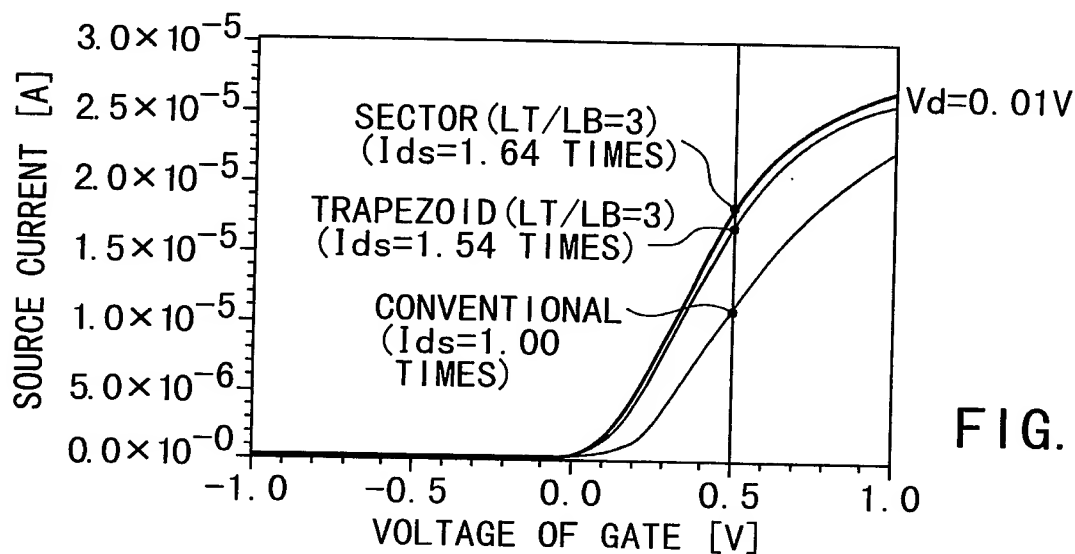


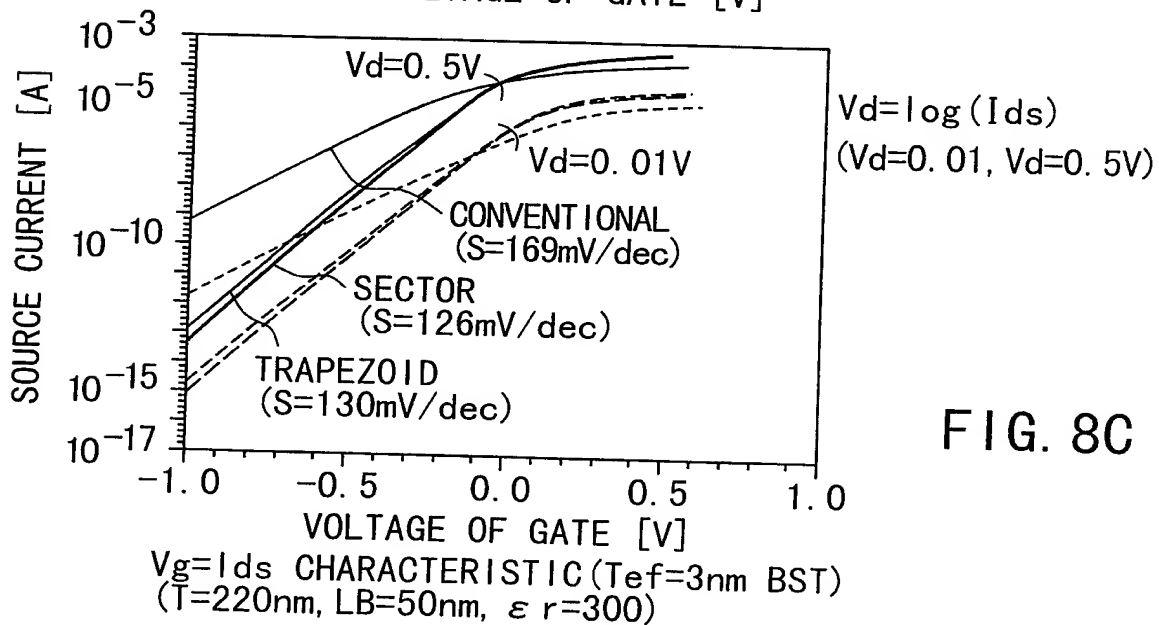
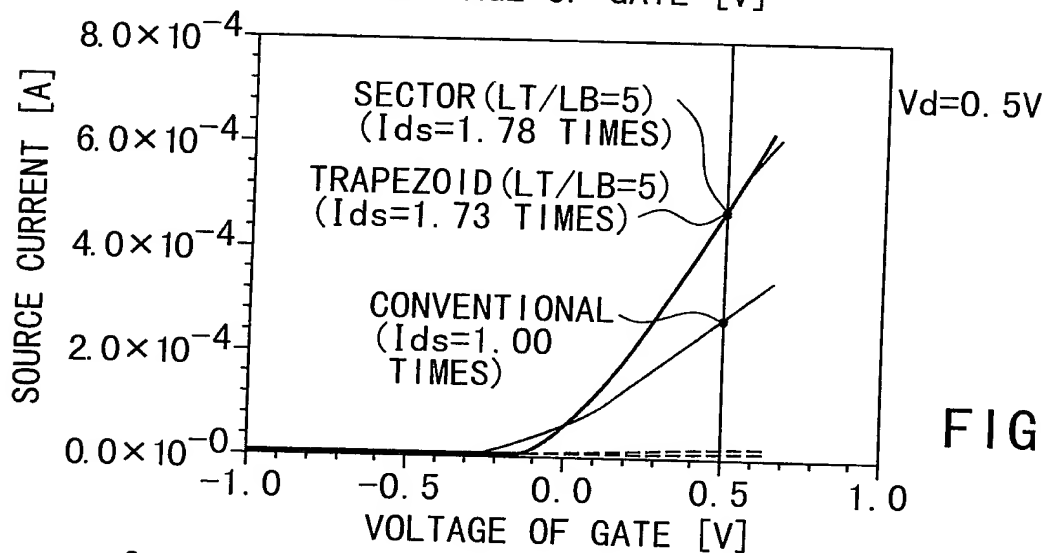
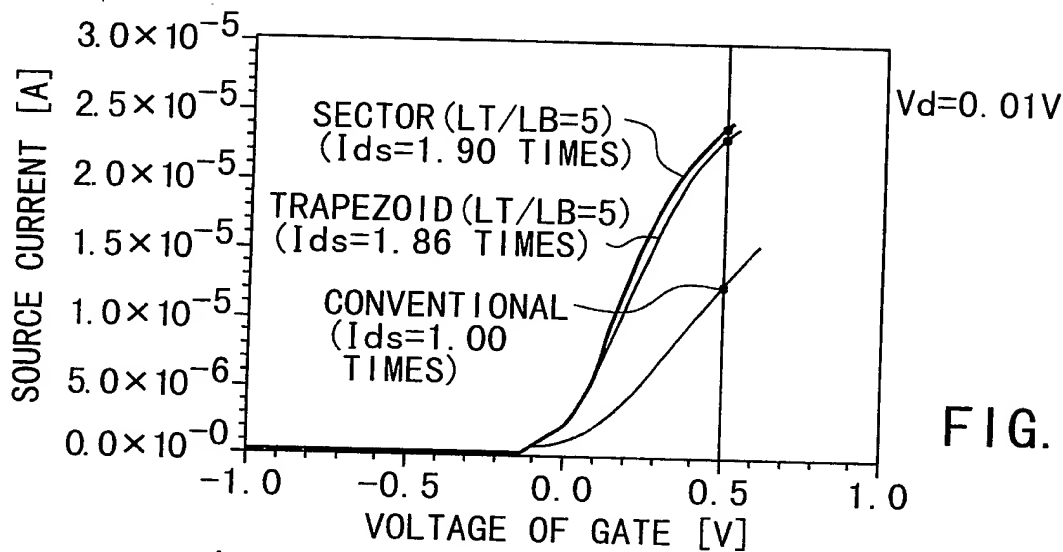
SECTOR (LT/LB=3)

FIG. 6C

EQUIPOTENTIAL LINE CHART  
 ( $V_g=1V$ )  $V_d=V_s=V_b=0V$ ,  $0.1V/div$   
 ( $T=60nm$ , ( $T_{ef}=3nm$ ),  $LB=50nm$ ,  $\epsilon_r=80(TiO_2)$ )

APPROVED	O.G. FIG.	
BY	CLASS	SUBCLASS
DRAFTSMAN		





# DISTRIBUTION OF ELECTRIC FIELD IN INSULATION FILM ( $V_d=V_s=V_b=0V$ , $T=60nm$ , $LB=50nm$ , $\epsilon_r=80$ ( $TiO_2$ ))

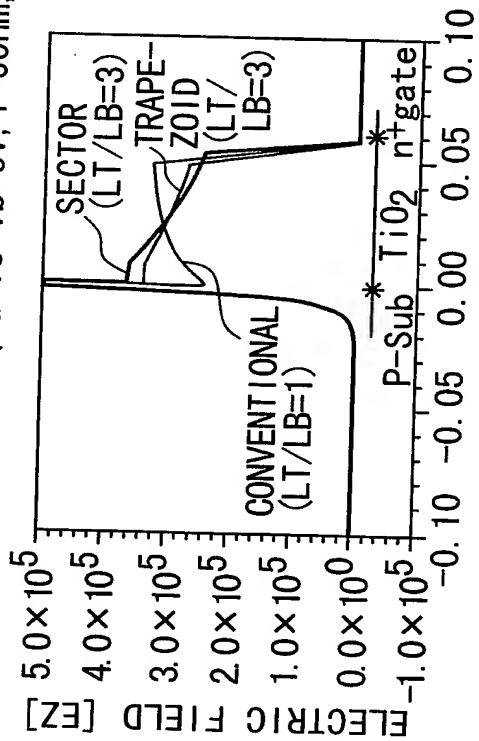


FIG. 9B

(a-1)  $V_g=3V$ ,  $X=0nm$

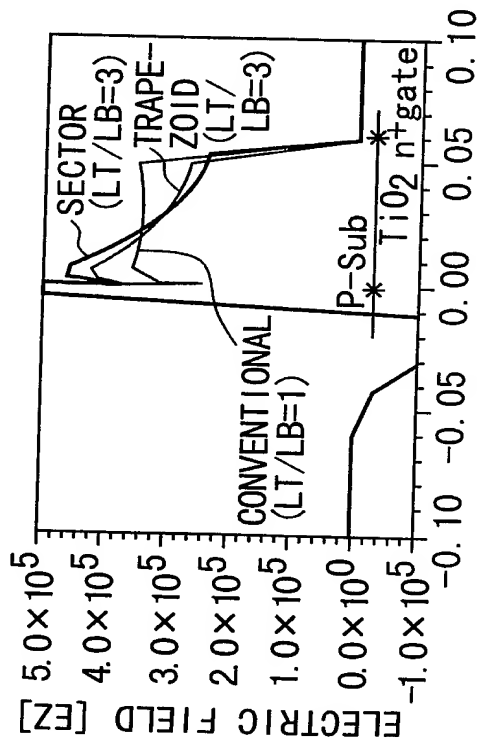


FIG. 9C

(a-2)  $V_g=3V$ ,  $X=20nm$

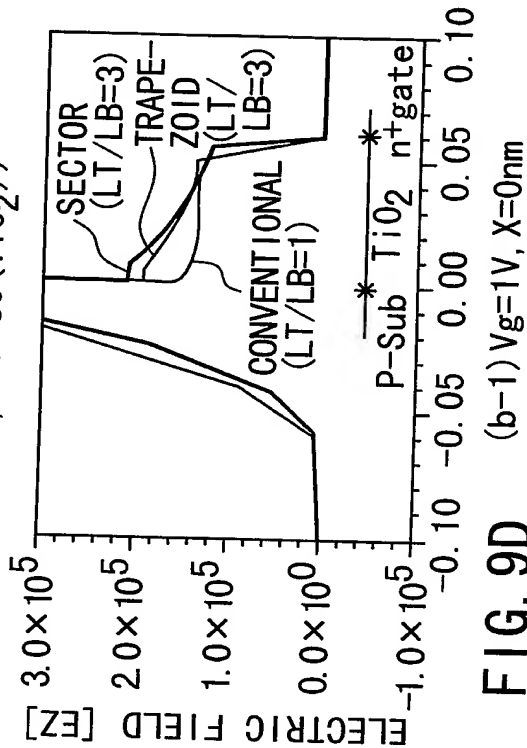
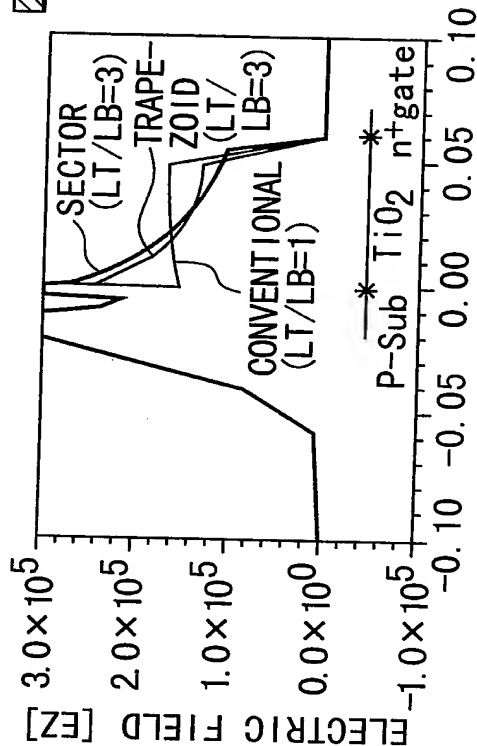


FIG. 9D

(b-1)  $V_g=1V$ ,  $X=0nm$



(b-2)  $V_g=1V$ ,  $X=20nm$

FIG. 9E

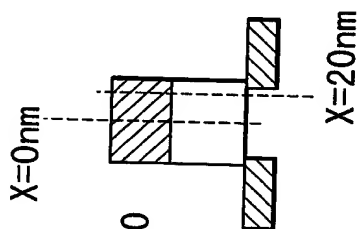
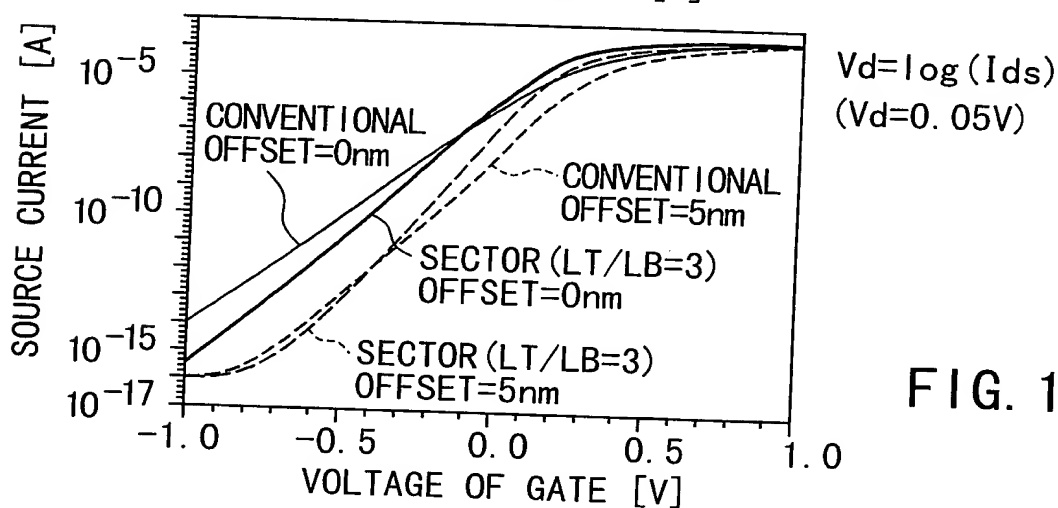
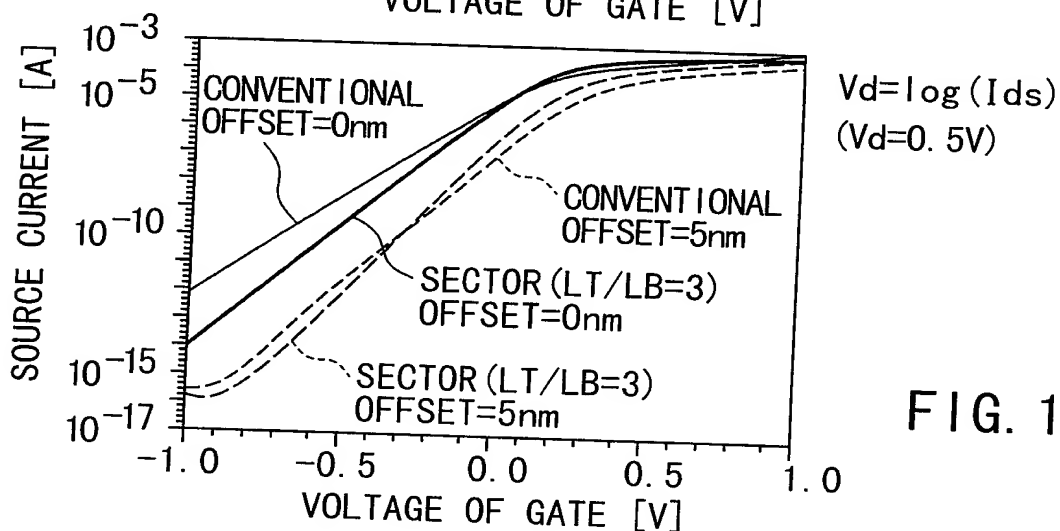
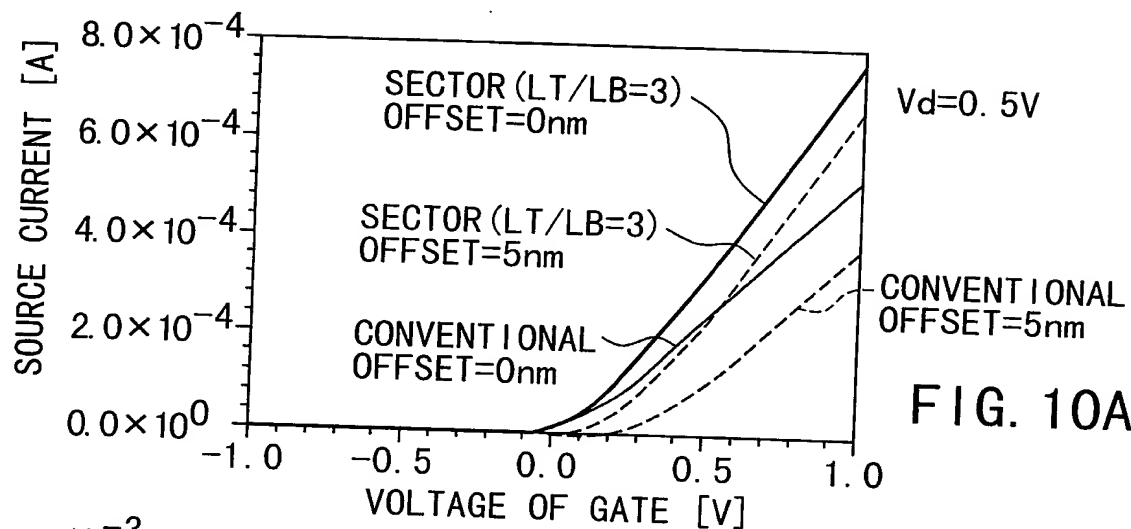


FIG. 9A



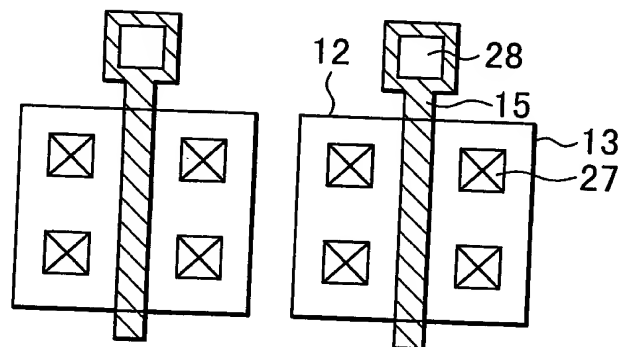
APPROVED	O.G. FIG.	
BY	CLASS	SUBCLASS
DRAFTSMAN		



OFFSET DEPENDENCY OF  $V_g = I_{ds}$  CHARACTERISTIC  
 ( $T_{ef} = 3.0\text{nm (TiO}_2\text{)}$ ,  $T = 60\text{nm}$ ,  $LB = 50\text{nm}$ ,  $\epsilon_r = 80$ )

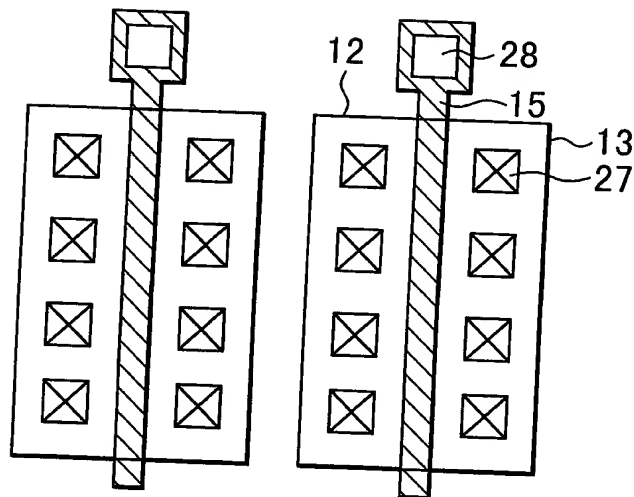


APPROVED	O.G. FIG.	
BY	CLASS	SUBCLASS
DRAFTSMAN		



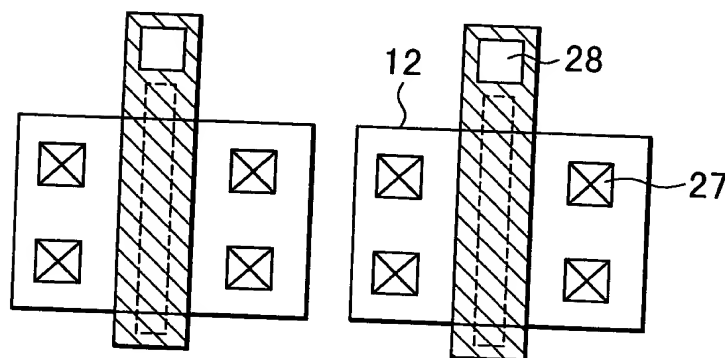
CONVENTIONAL  
(W=1)

FIG. 12A  
(PRIOR ART)



CONVENTIONAL  
(W=1.8)

FIG. 12B  
(PRIOR ART)



PRESENT  
INVENTION  
(W=1)

FIG. 12C

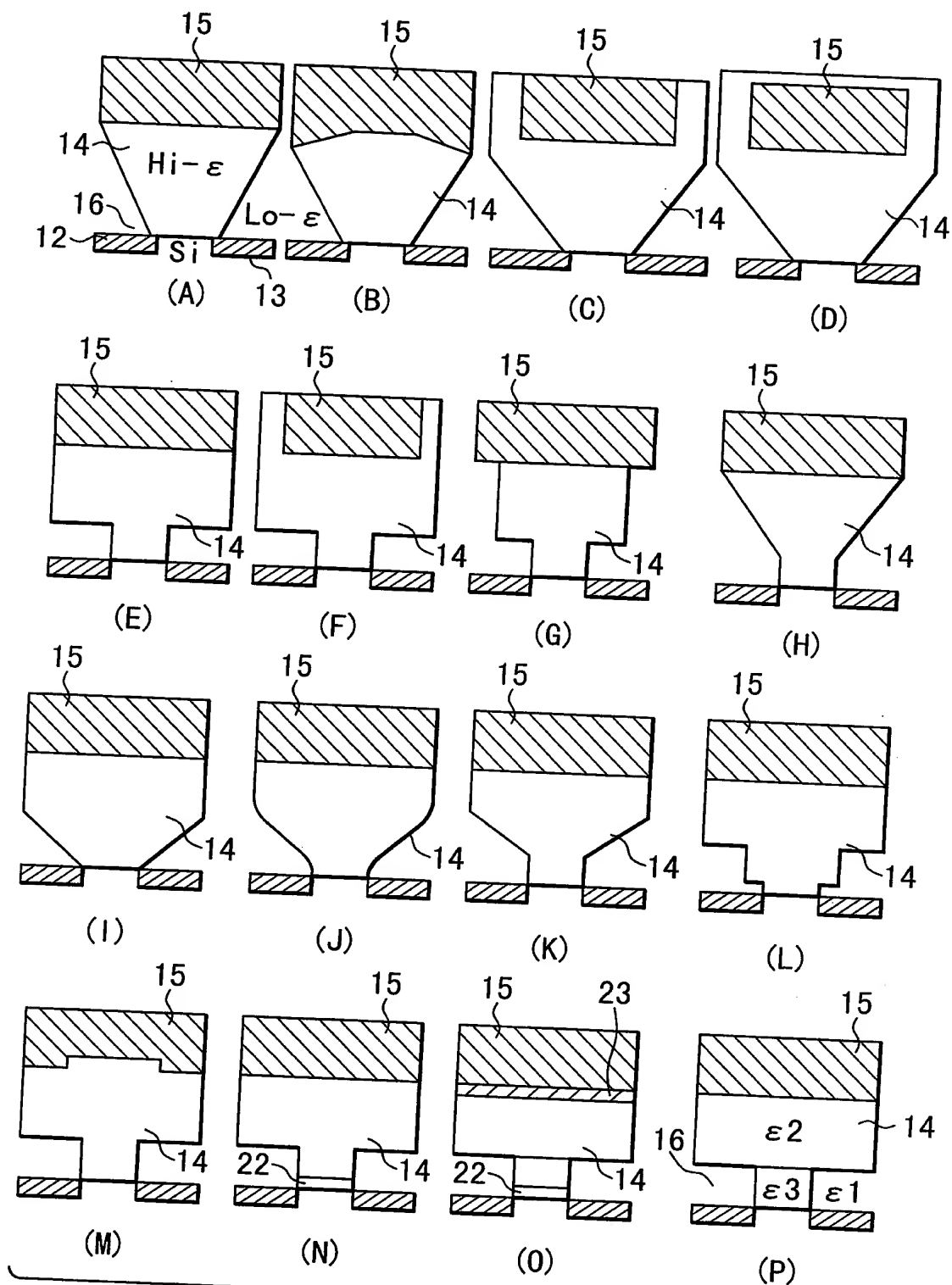


FIG. 13

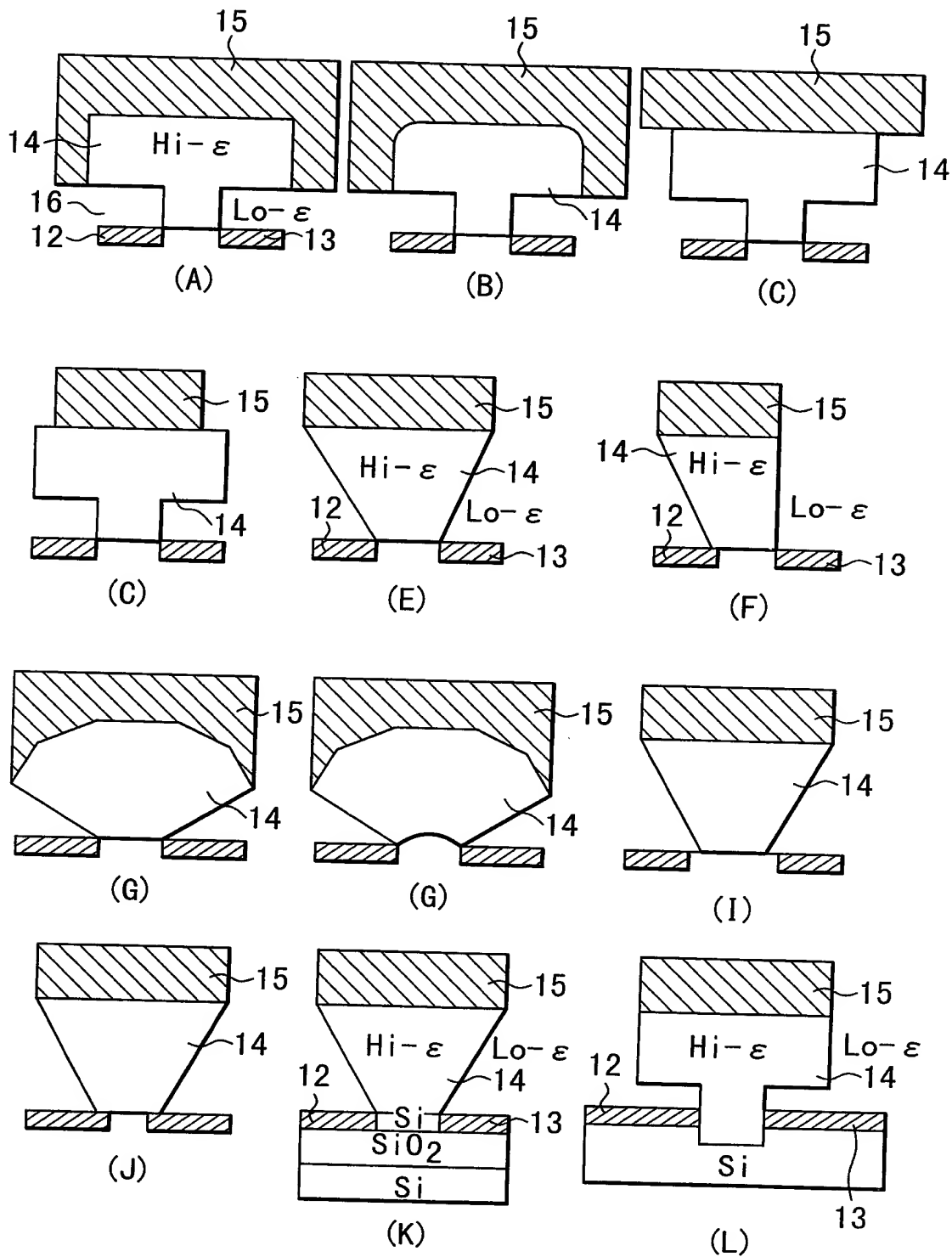


FIG. 14

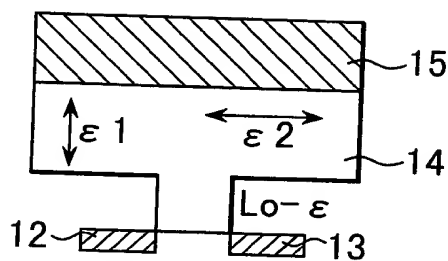


FIG. 15A

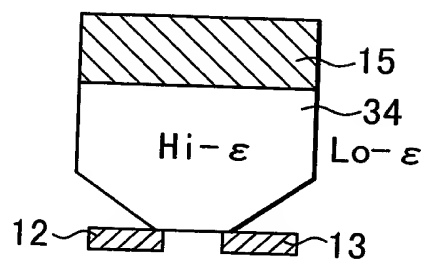


FIG. 15B

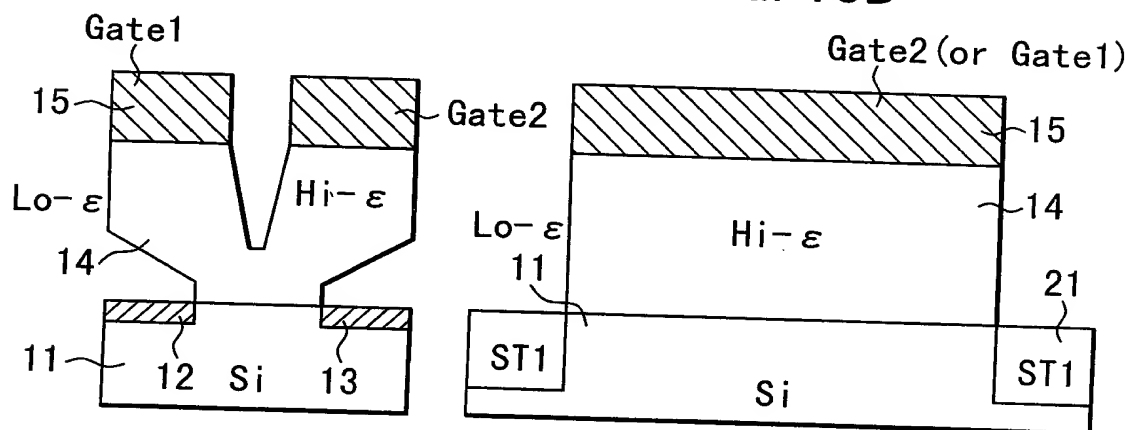


FIG. 15C

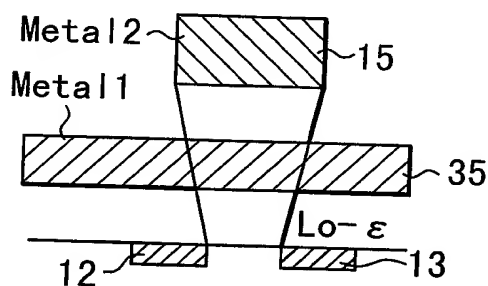


FIG. 15D

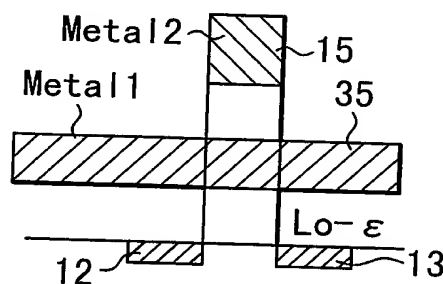


FIG. 15E

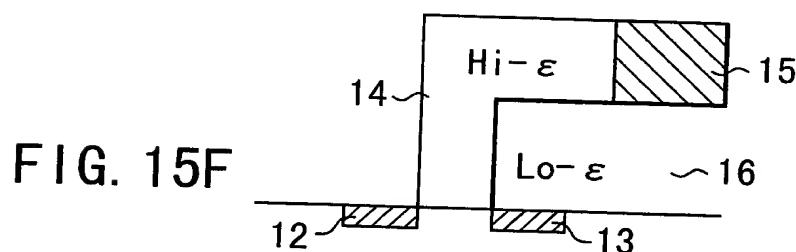


FIG. 15F

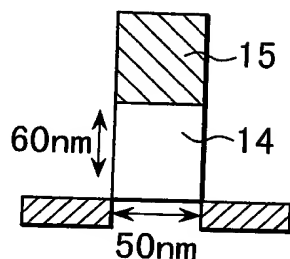


FIG. 16A

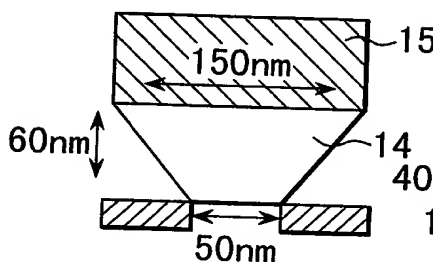


FIG. 16B

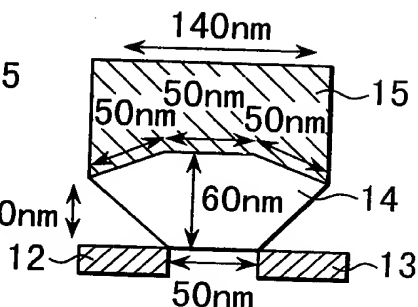


FIG. 16C

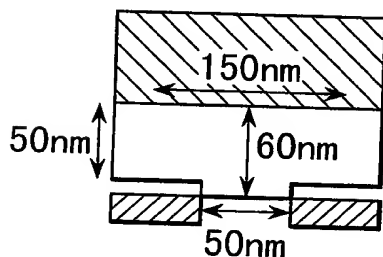


FIG. 16D

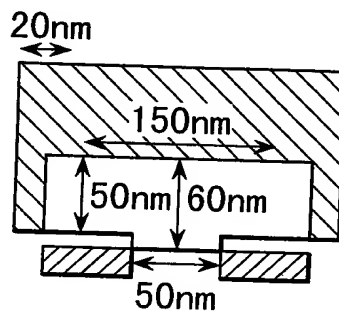


FIG. 16E

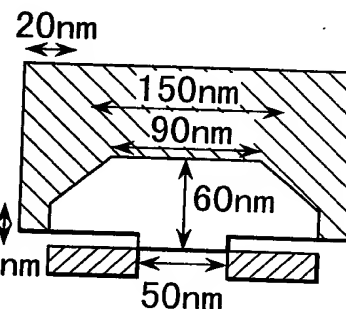


FIG. 16F

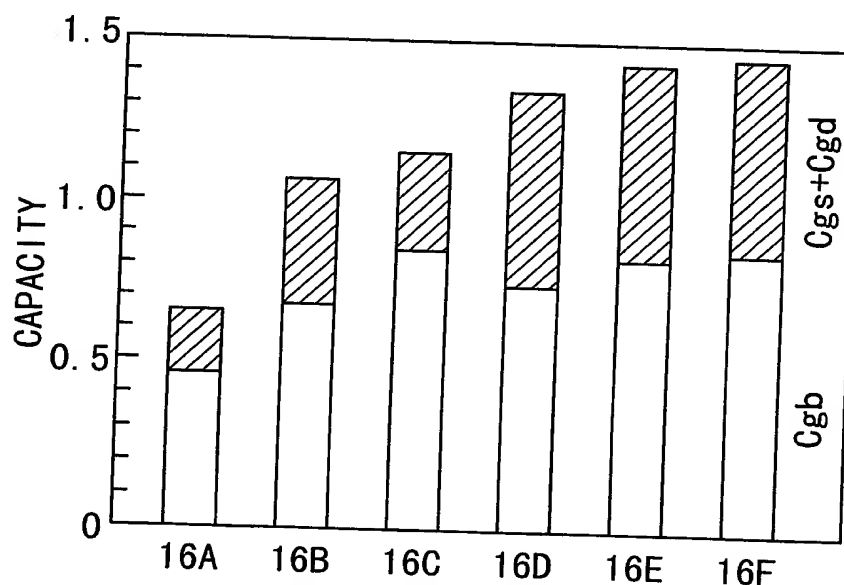
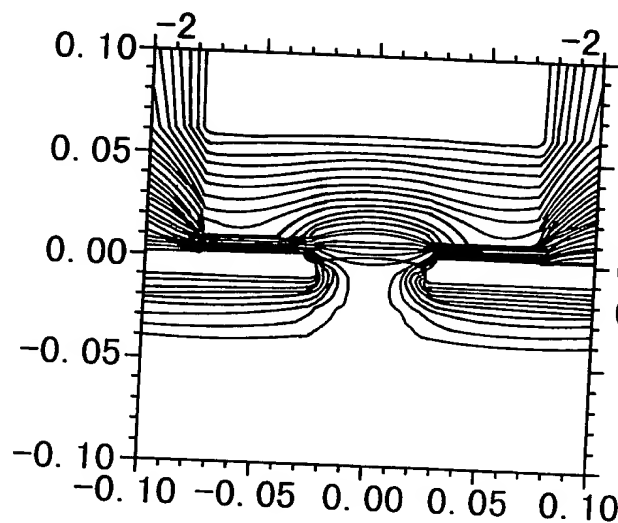


FIG. 16G

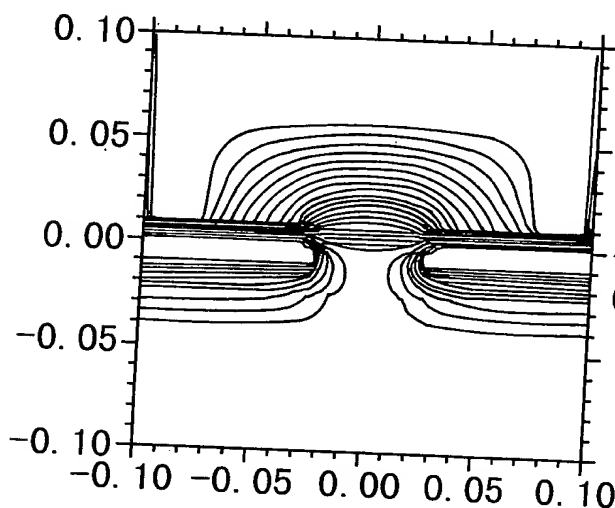
SHAPE DEPENDENCY OF  
 EACH CAPACITY COMPONENT  
 $T_{ef}=3.0\text{nm}$   $\epsilon_r=80(\text{TiO}_2)$

APPROVED	O.G. FIG.	
BY	CLASS	SUBCLASS
DRAFTSMAN		



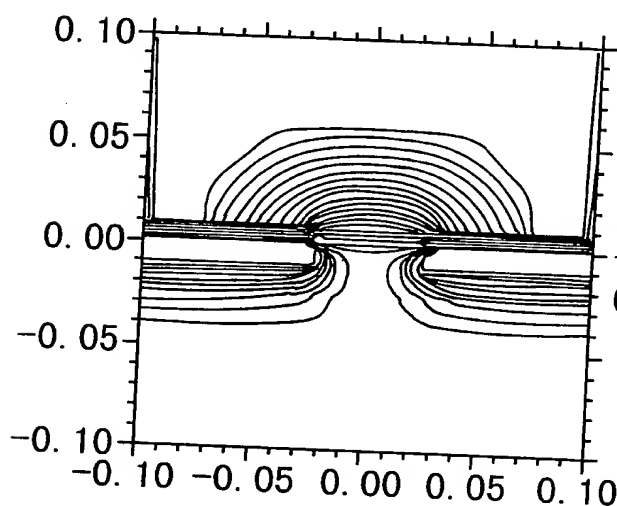
REVERSE-CONVEX TYPE  
 (LT/LB=3)

FIG. 17A



THICKNESS FILM  
 STACK TYPE

FIG. 17B



THICKNESS FILM  
 STACK SECTOR

FIG. 17C

EQUIPOTENTIAL LINE CHART  
 ( $V_g = -3V$ )  $V_d = V_s = V_b = 0V$ , 0.1V/div  
 ( $T = 60nm$ , ( $T_{ef} = 3nm$ ),  $LB = 50nm$ ,  $\epsilon_r = 80(TiO_2)$ )



APPROVED	O.G. FIG.	
BY	CLASS	SUBCLASS
DRAFTSMAN		

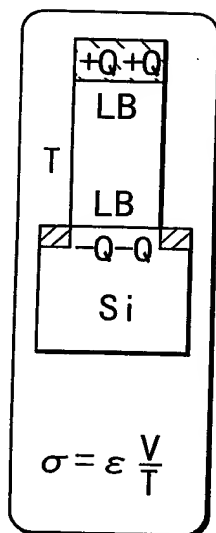


FIG. 18A  
(PRIOR ART)

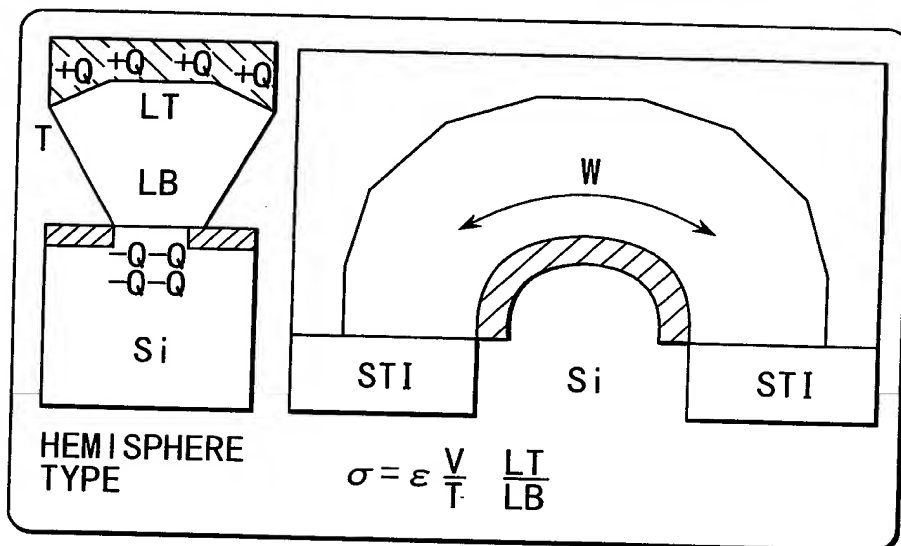


FIG. 18B

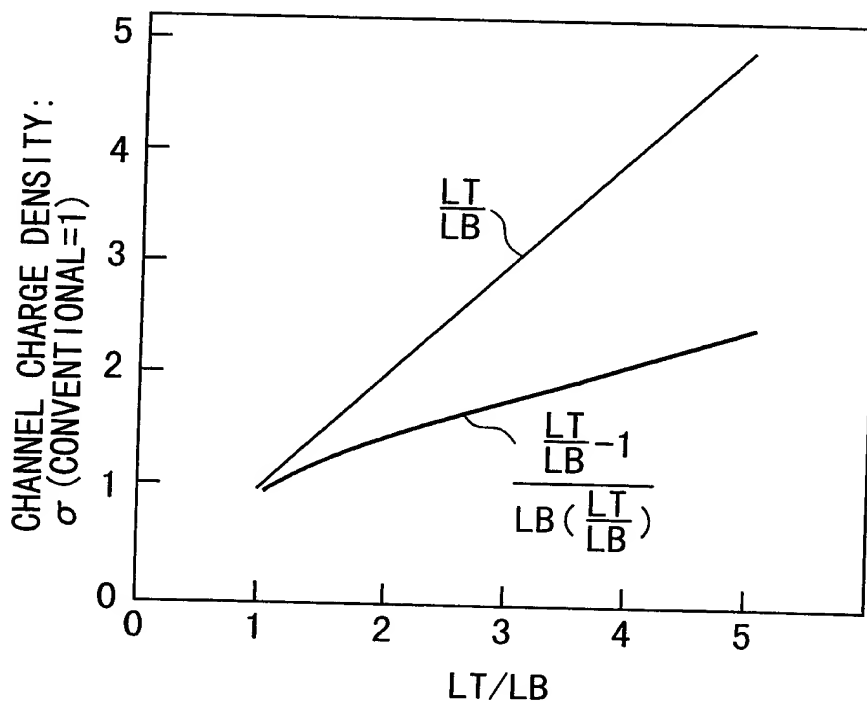


FIG. 18C

APPROVED	O.G. FIG.	
BY	CLASS	SUBCLASS
DRAFTSMAN		

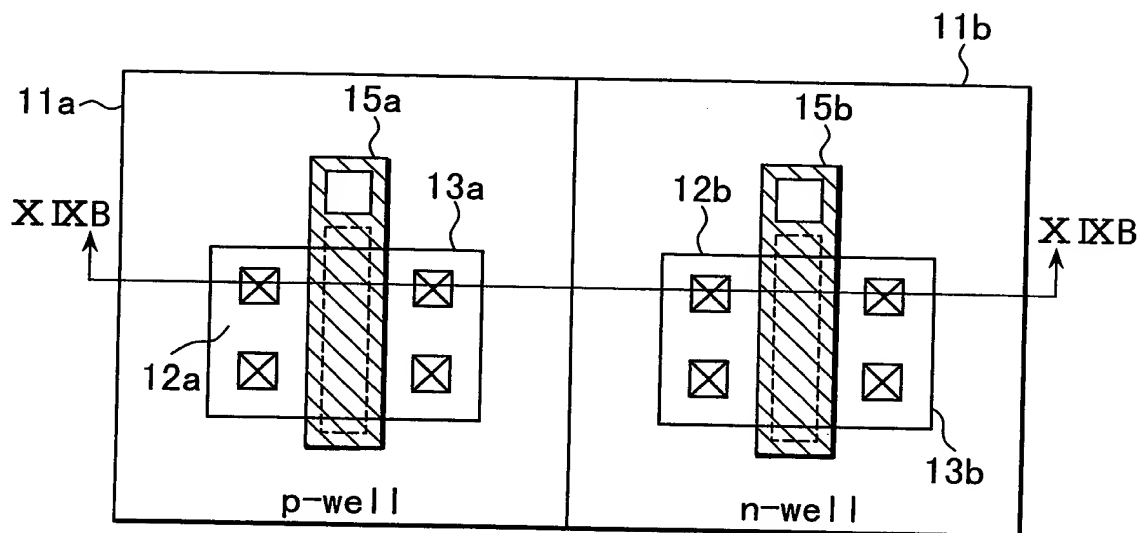


FIG. 19A

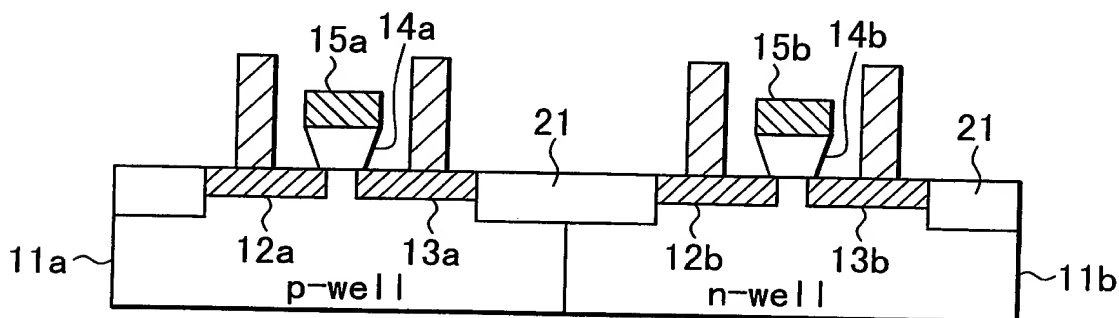


FIG. 19B

APPROVED	O.G. FIG.	
BY	CLASS	SUBCLASS
DRAFTSMAN		

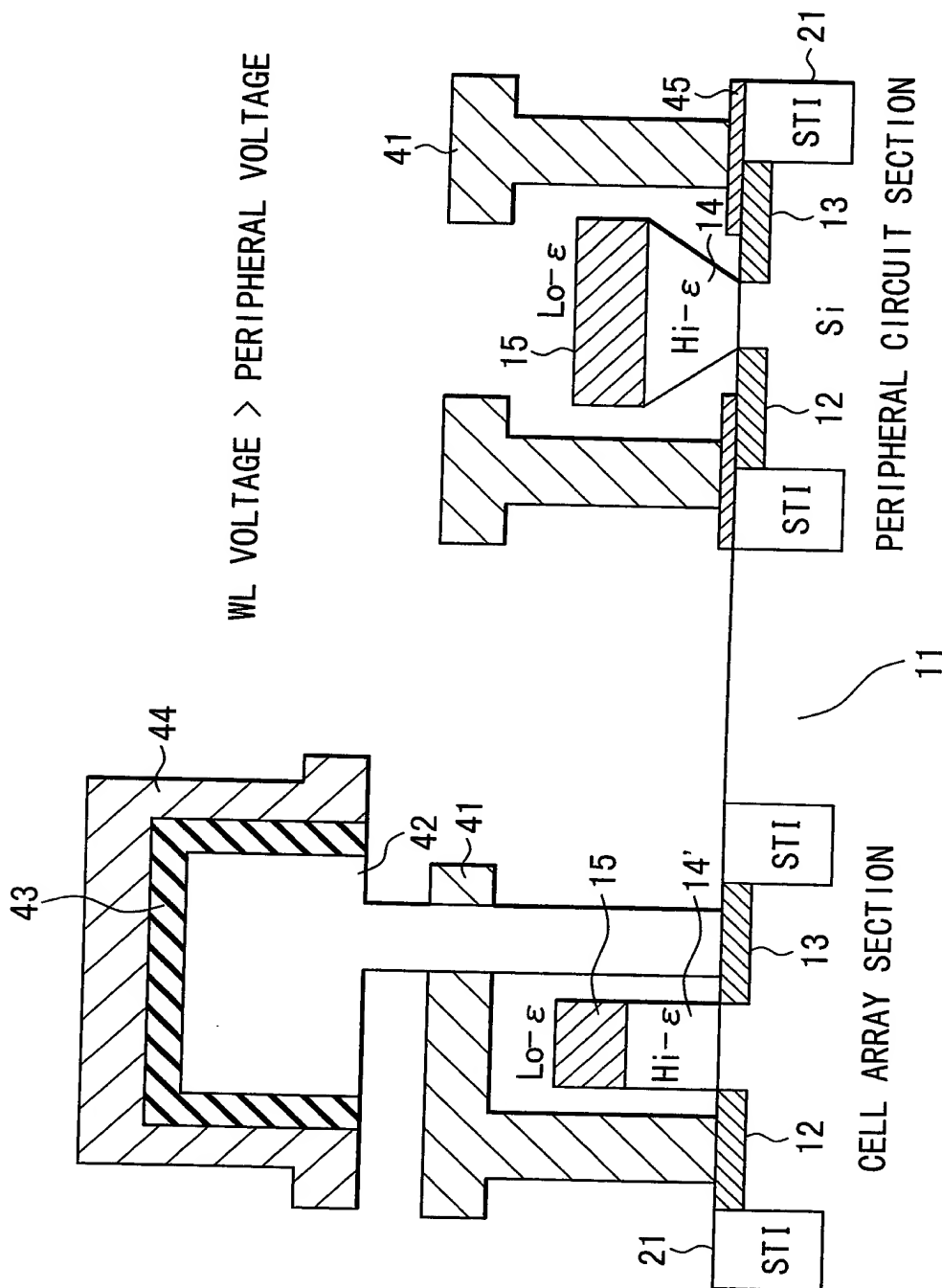
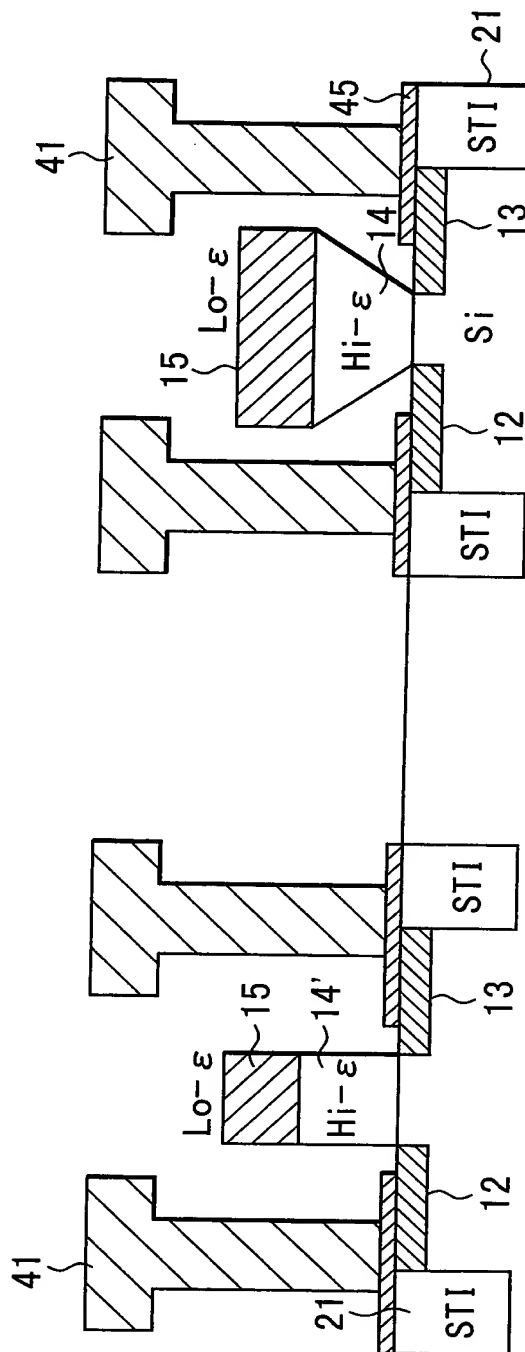
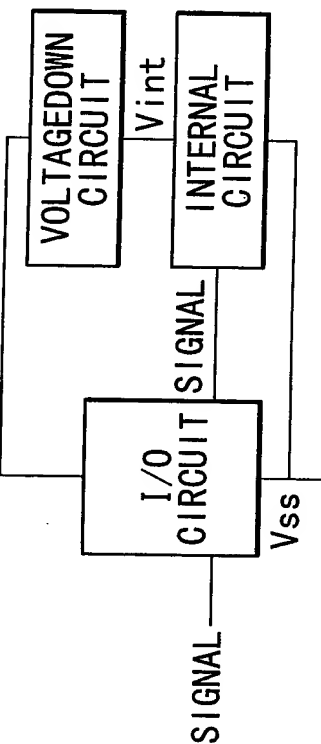


FIG. 20

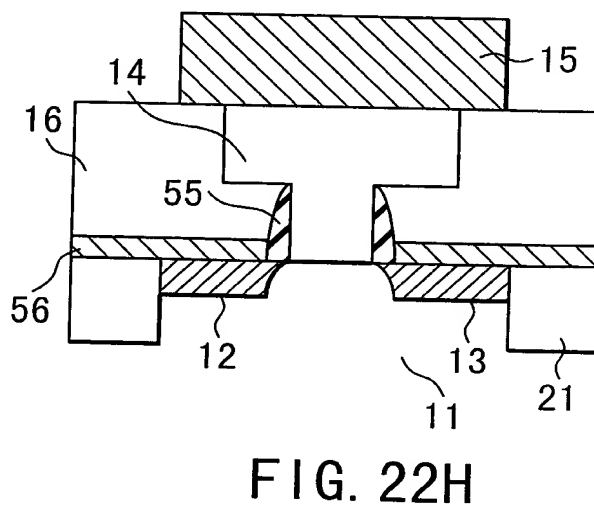
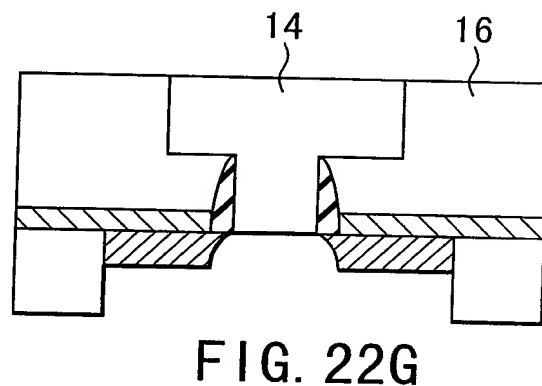
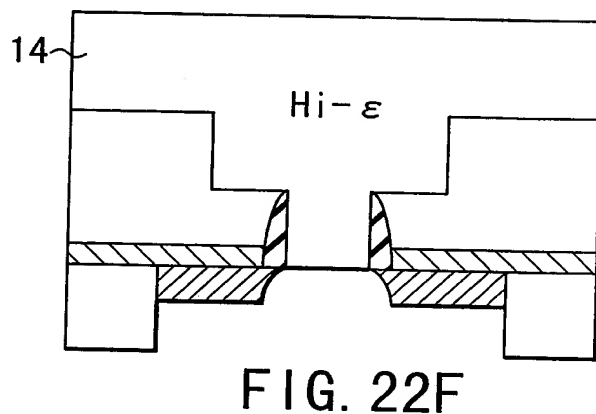
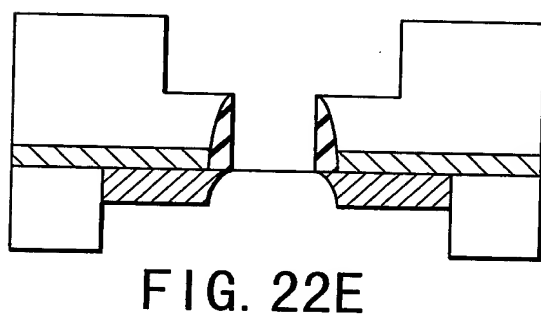
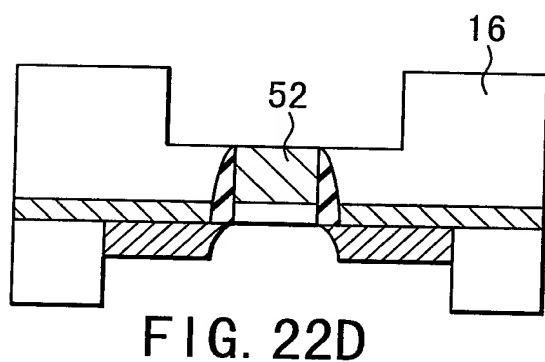
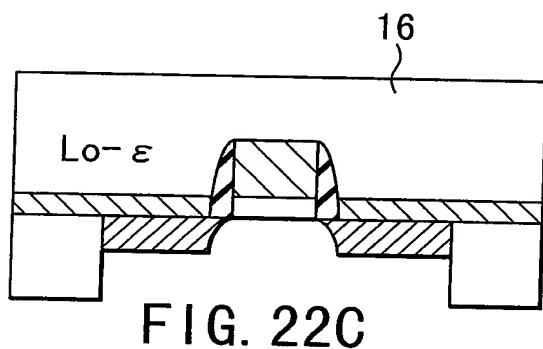
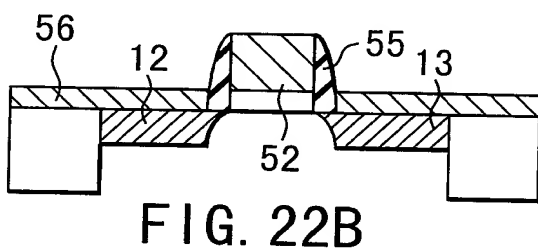
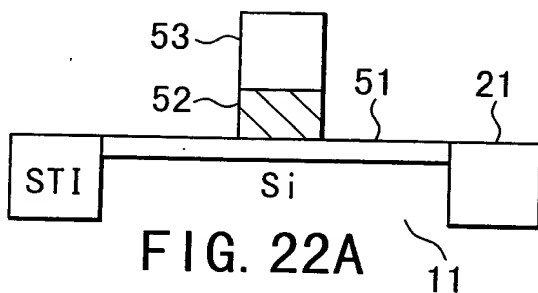
**FIG. 21A**

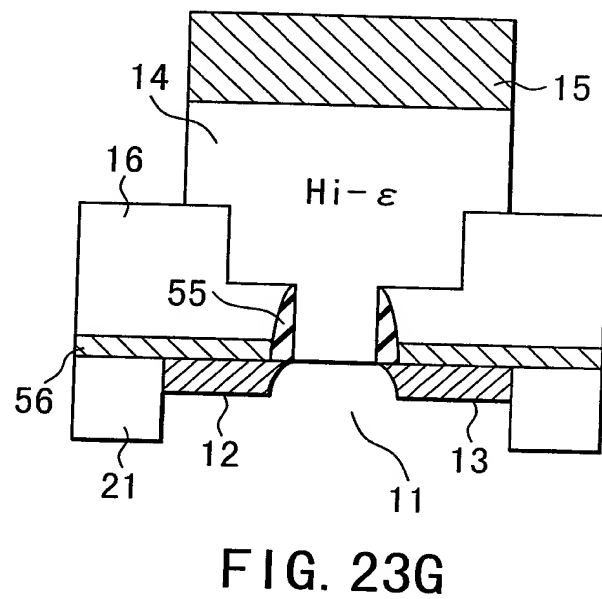
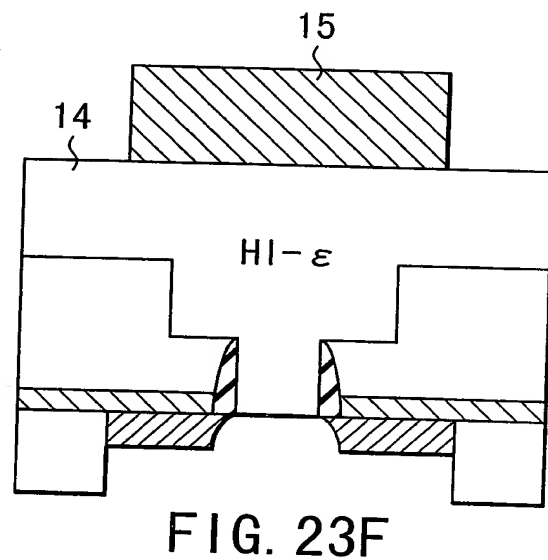
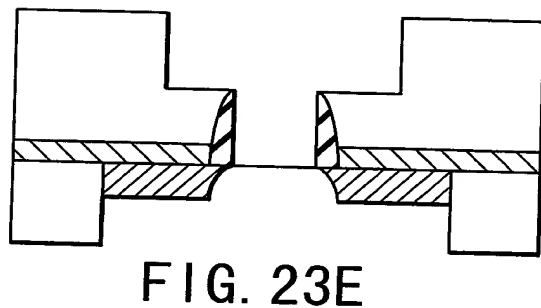
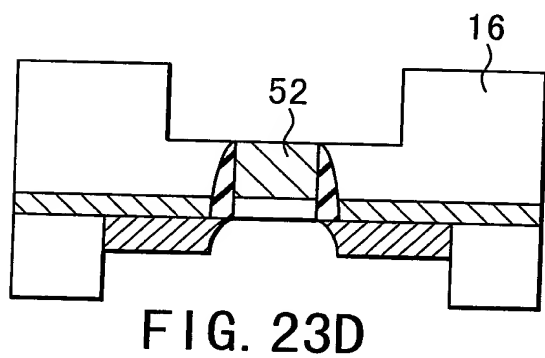
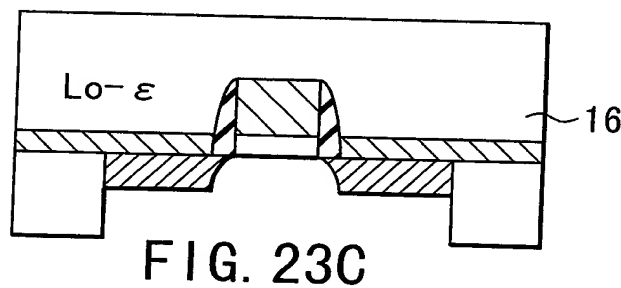
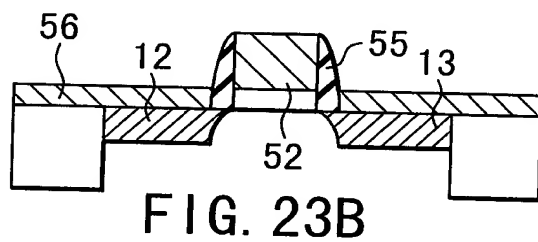
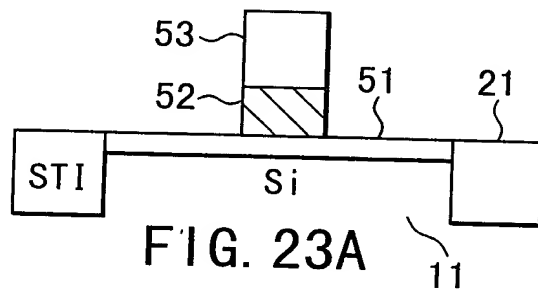


CELL ARRAY SECTION

## PERIPHERAL CIRCUIT SECTION

**FIG. 21B**





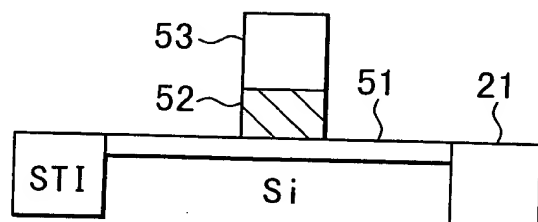


FIG. 24A

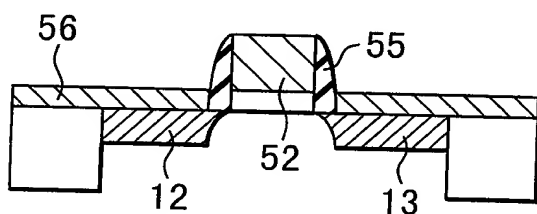


FIG. 24B

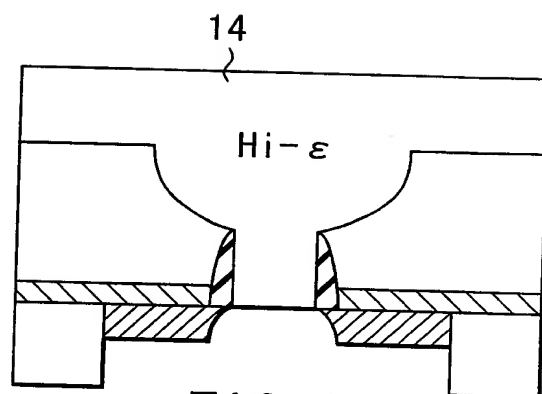


FIG. 24F

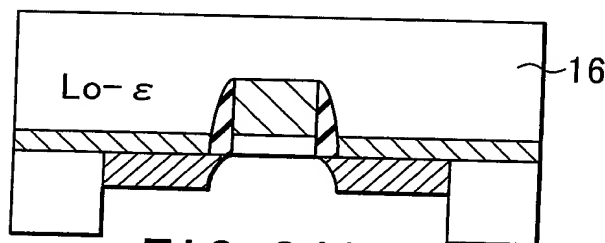


FIG. 24C

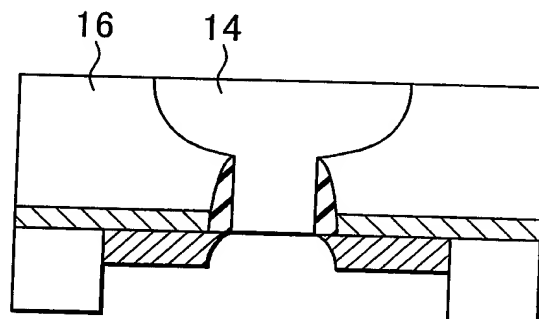


FIG. 24G

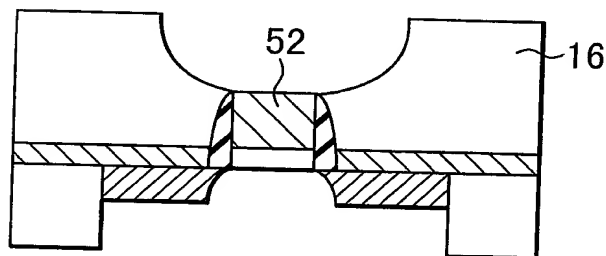


FIG. 24D

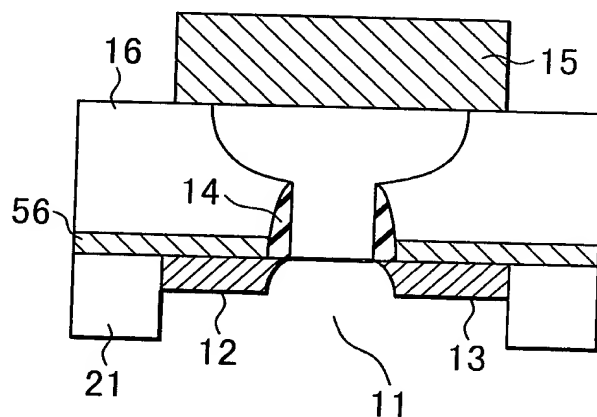


FIG. 24H

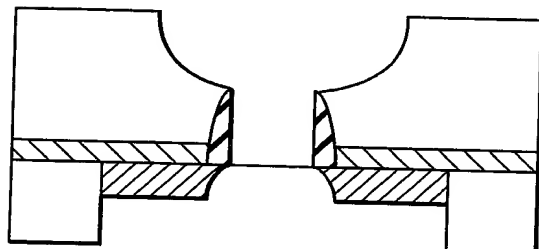


FIG. 24E

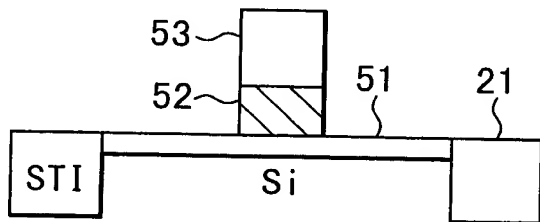


FIG. 25A

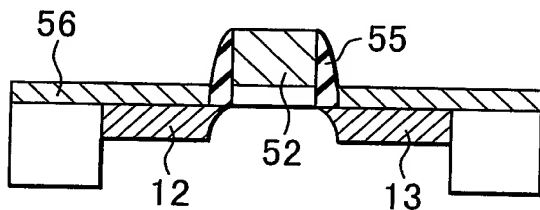


FIG. 25B

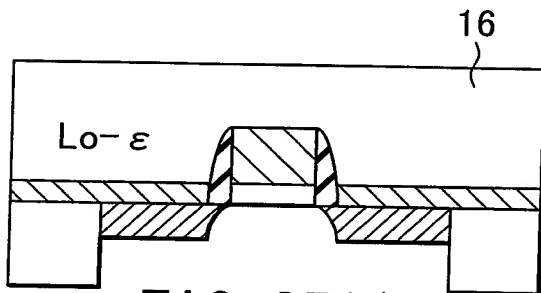


FIG. 25C

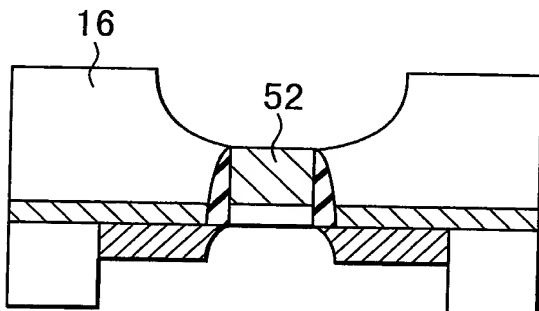


FIG. 25D

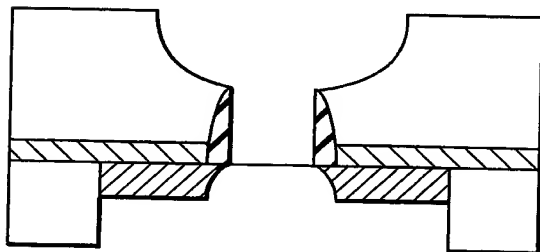


FIG. 25E

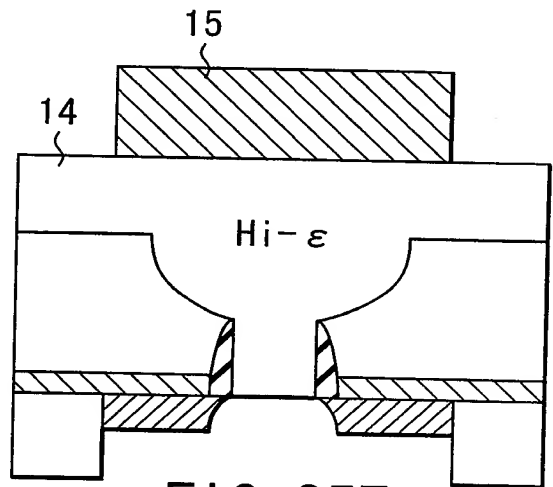


FIG. 25F

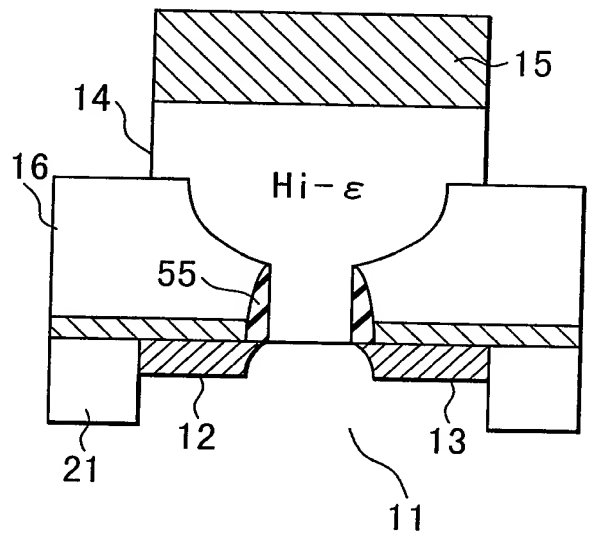


FIG. 25G



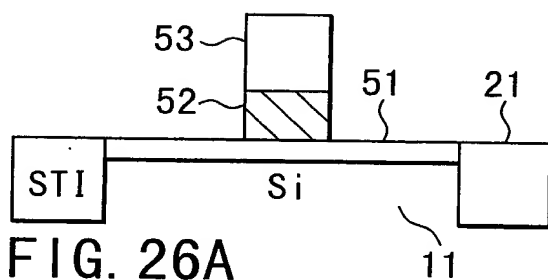


FIG. 26A

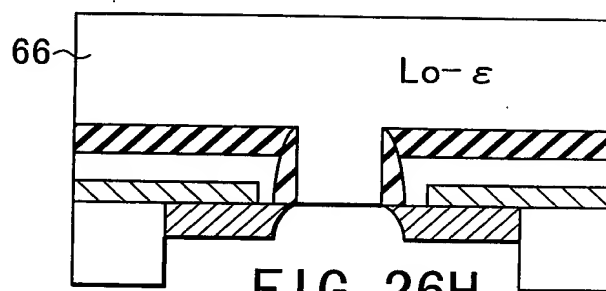


FIG. 26H

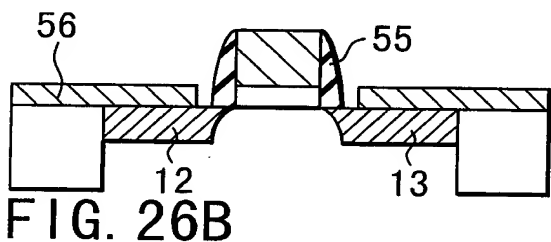


FIG. 26B

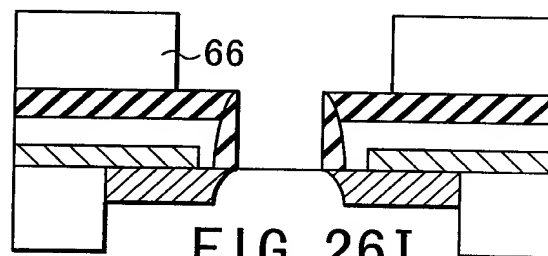


FIG. 26I

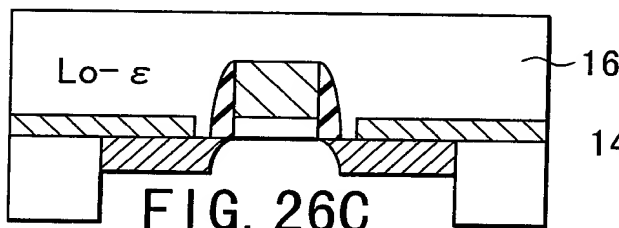


FIG. 26C

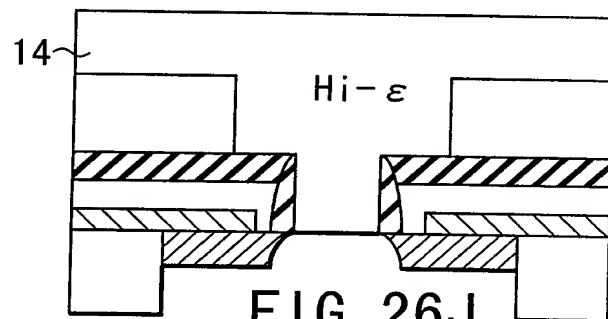


FIG. 26J

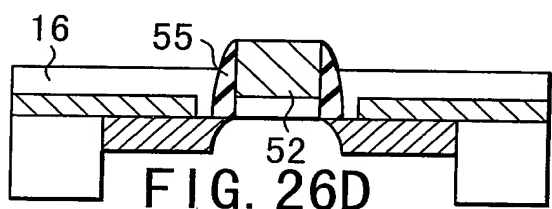


FIG. 26D

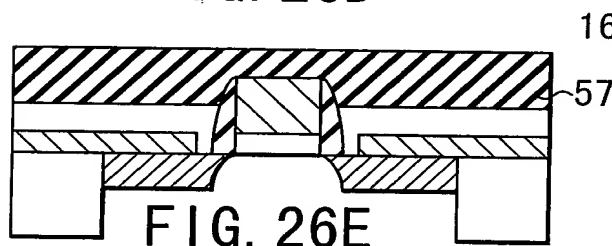


FIG. 26E

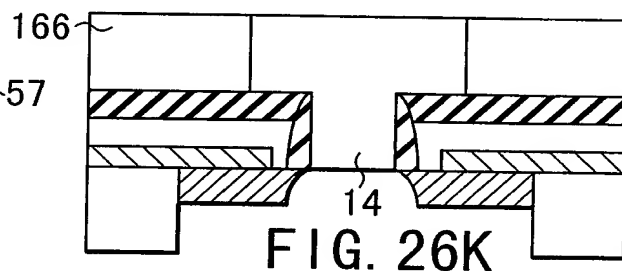


FIG. 26K

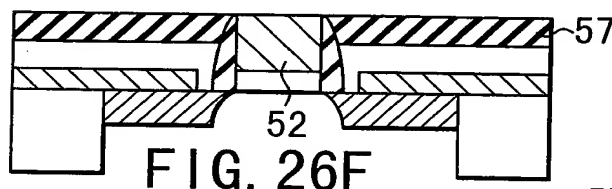


FIG. 26F

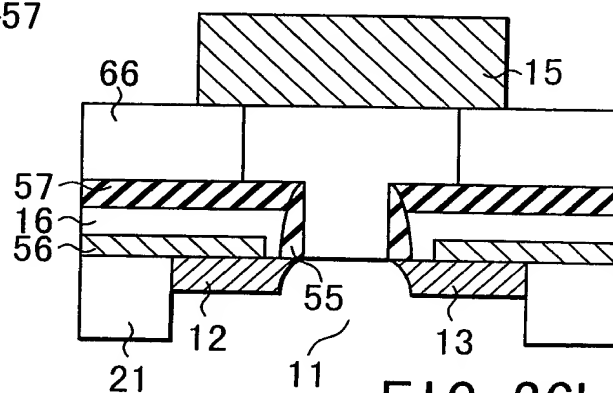


FIG. 26L

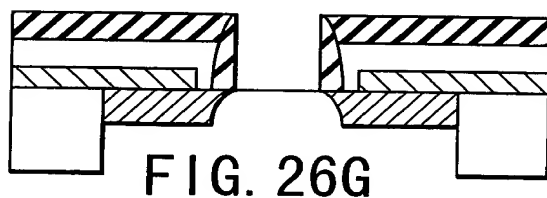


FIG. 26G

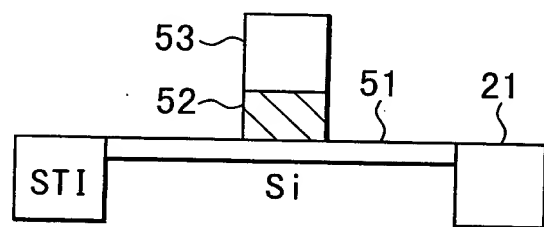


FIG. 27A

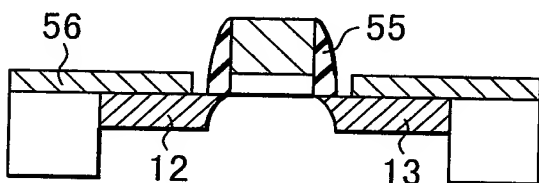


FIG. 27B

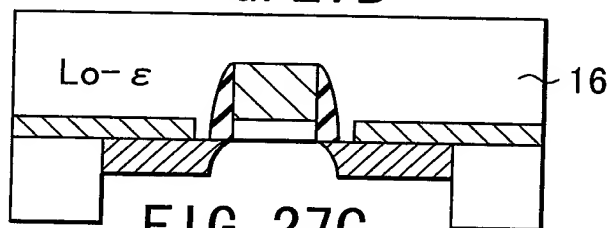


FIG. 27C

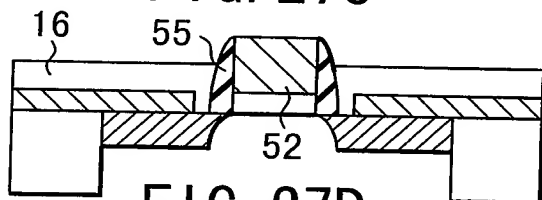


FIG. 27D

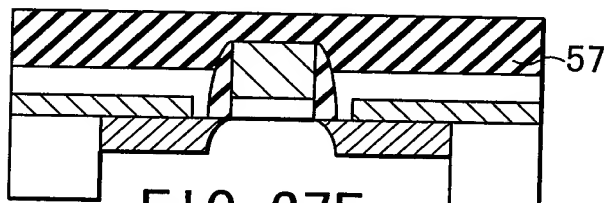


FIG. 27E

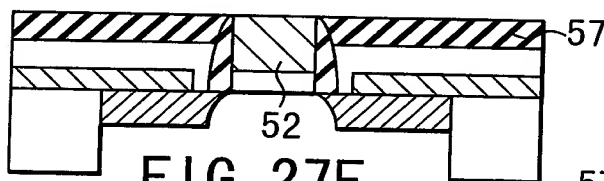


FIG. 27F

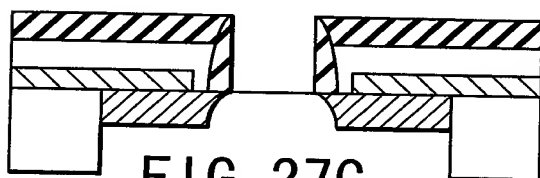


FIG. 27G

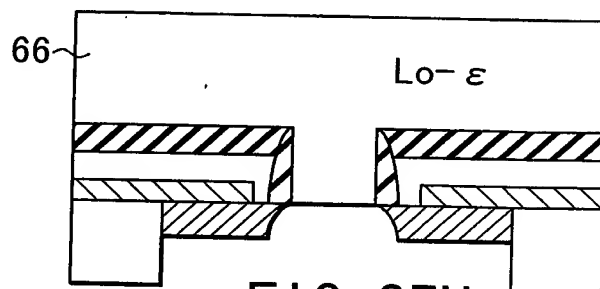


FIG. 27H

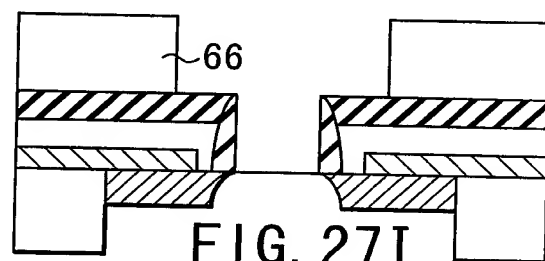


FIG. 27I

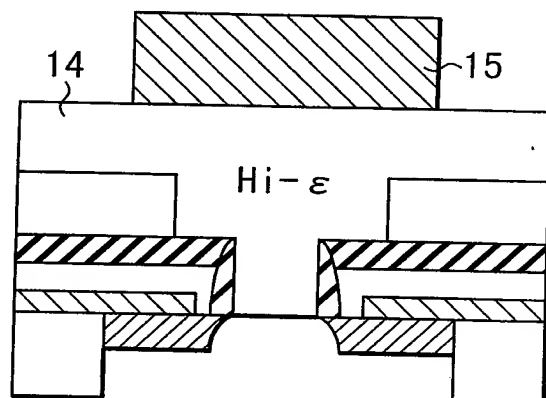


FIG. 27J

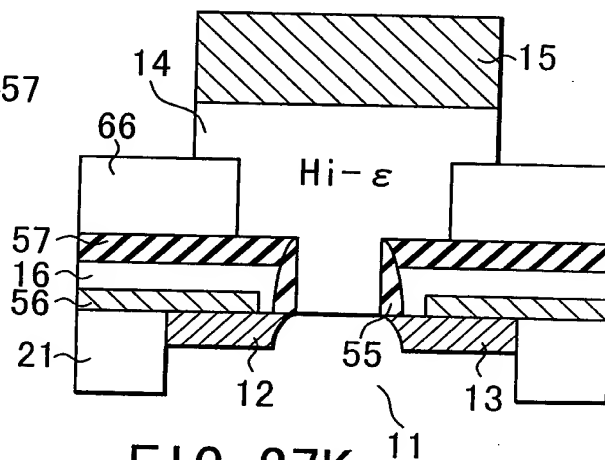


FIG. 27K

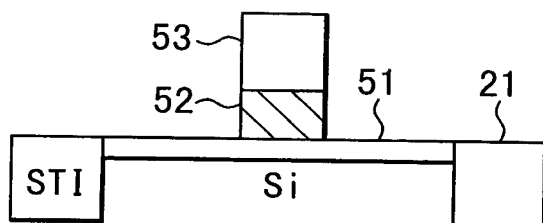


FIG. 28A

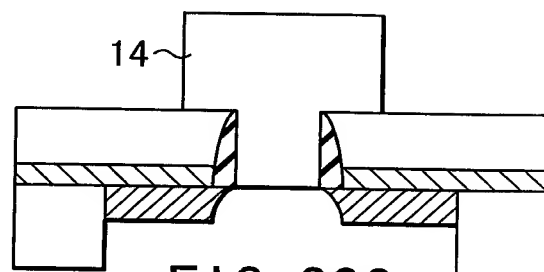


FIG. 28G

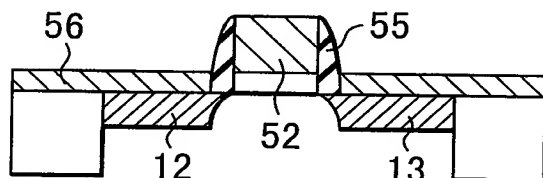


FIG. 28B

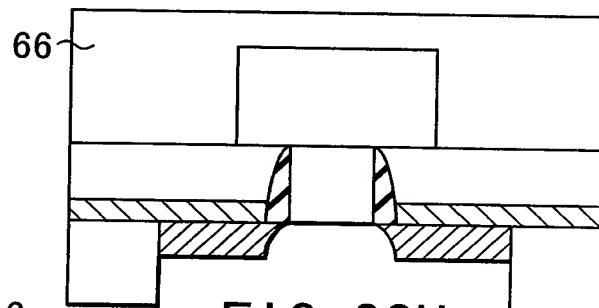


FIG. 28H

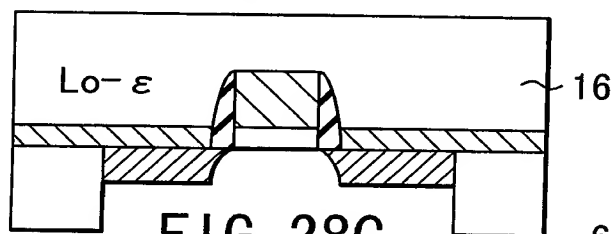


FIG. 28C

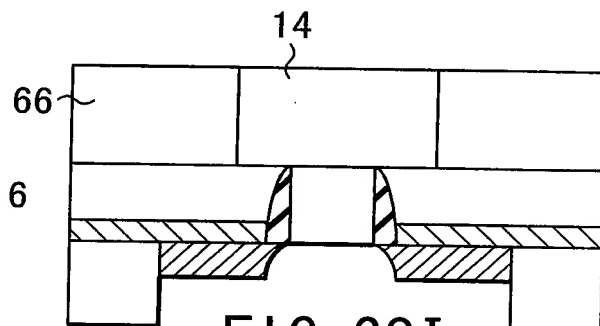


FIG. 28I

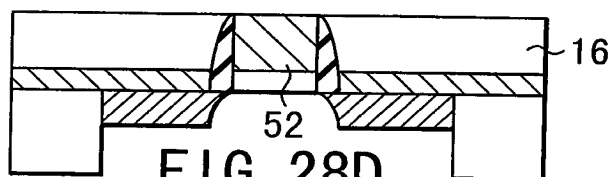


FIG. 28D

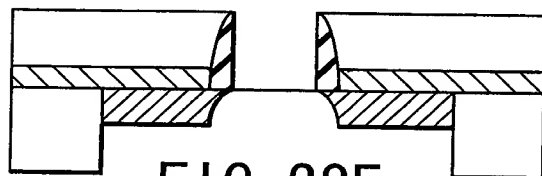


FIG. 28E

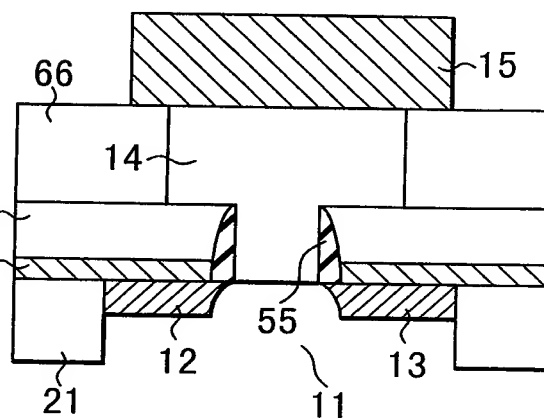


FIG. 28J

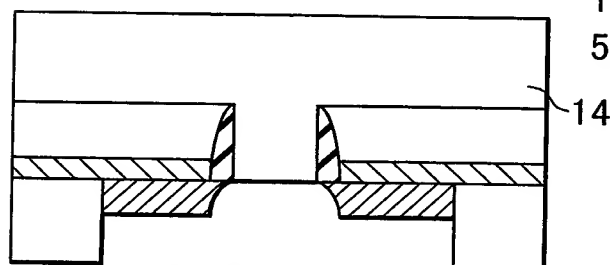


FIG. 28F

APPROVED	O.G. FIG.	
BY	CLASS	SUBCLASS
DRAFTSMAN		

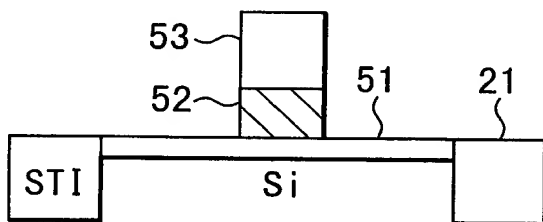


FIG. 29A

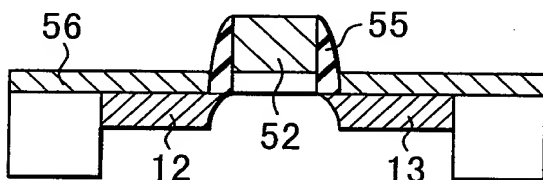


FIG. 29B

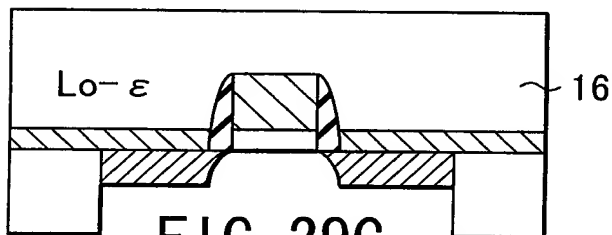


FIG. 29C

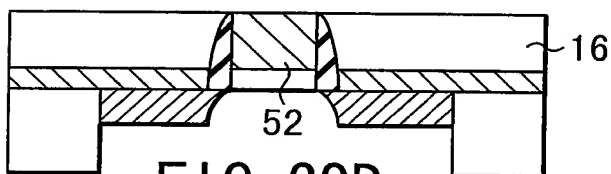


FIG. 29D

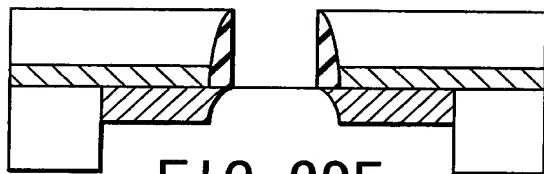


FIG. 29E

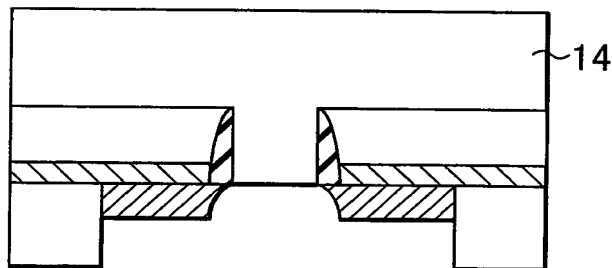


FIG. 29F

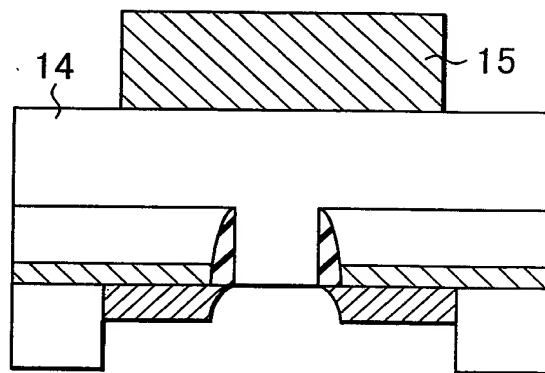


FIG. 29G

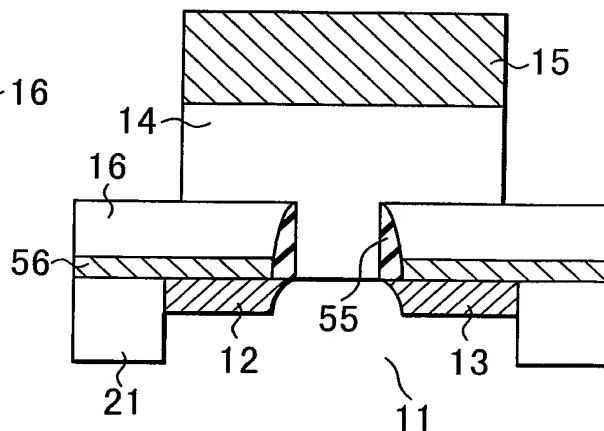


FIG. 29H

APPROVED	O.G. FIG.
BY	CLASS
DRAFTSMAN	SUBCLASS

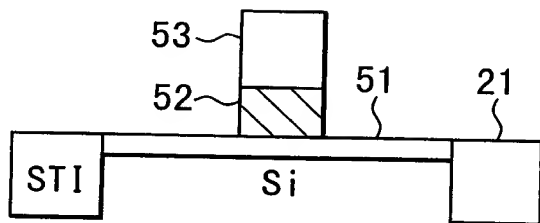


FIG. 30A

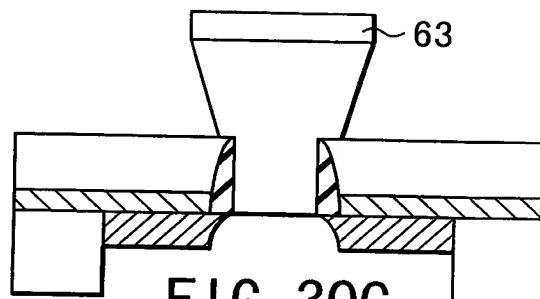


FIG. 30G

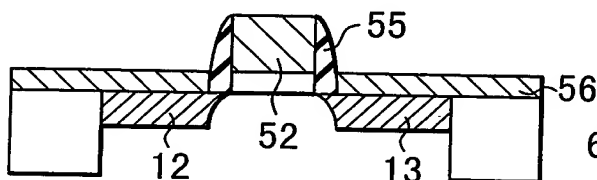


FIG. 30B

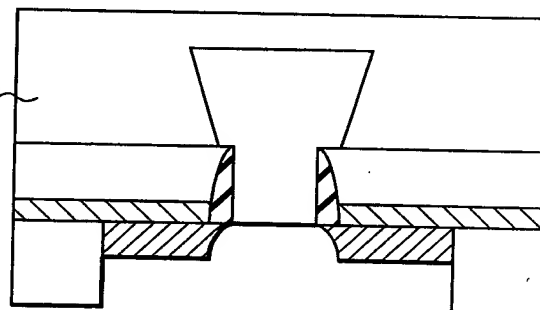


FIG. 30H

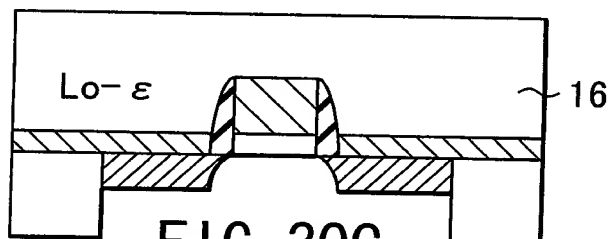


FIG. 30C

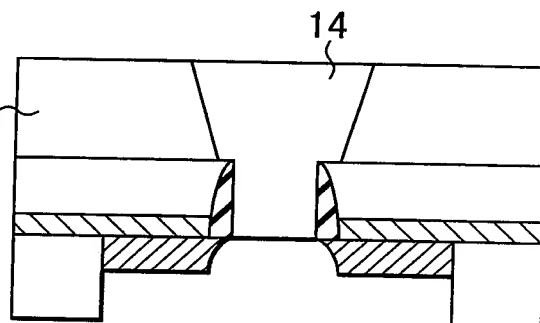


FIG. 30I

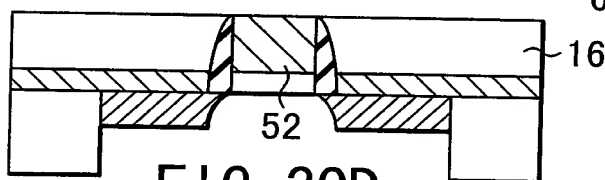


FIG. 30D

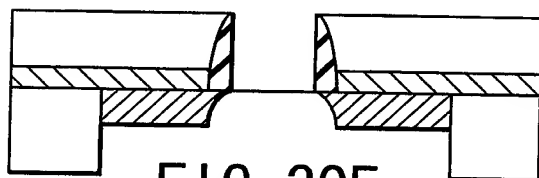


FIG. 30E

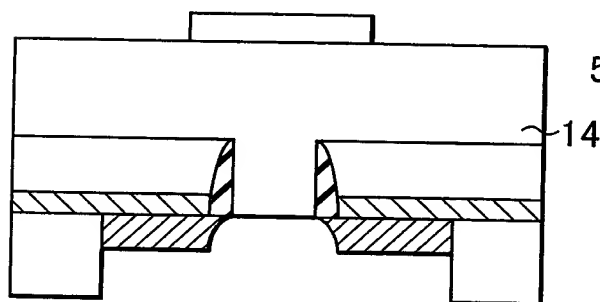


FIG. 30F

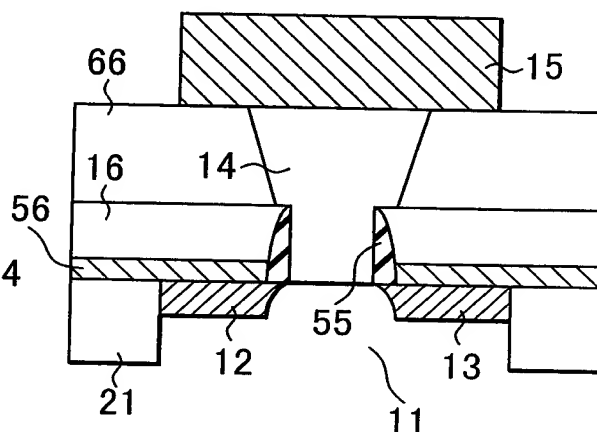


FIG. 30J

FIG. 30A: Cross-sectional view of a semiconductor device. It shows a substrate with a central region labeled 'Si' and side regions labeled 'STI'. A layer 51 is on top of the Si region, with a sub-layer 52. A structure 53 is on top of 52. A contact 21 is on the right side.

APPROVED	O.G. FIG.	
BY	CLASS	SUBCLASS
DRAFTSMAN		

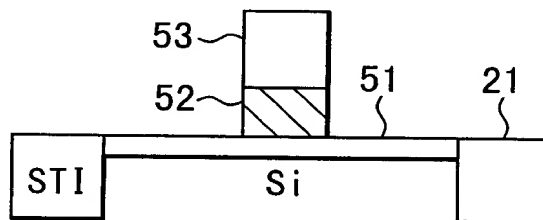


FIG. 31A

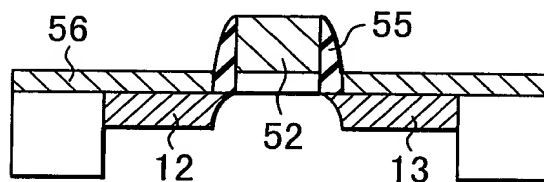


FIG. 31B

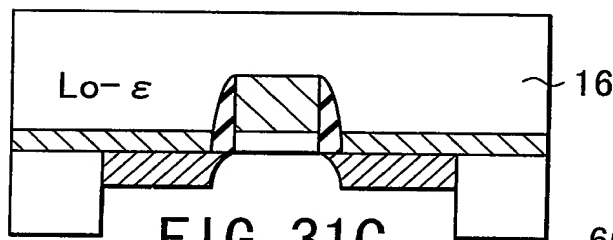


FIG. 31C

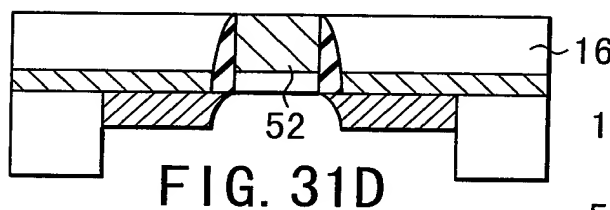


FIG. 31D

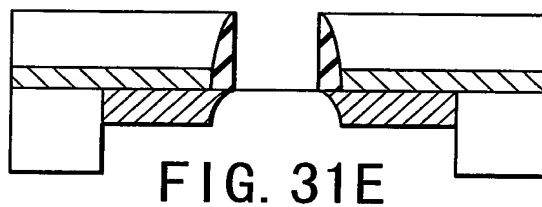


FIG. 31E

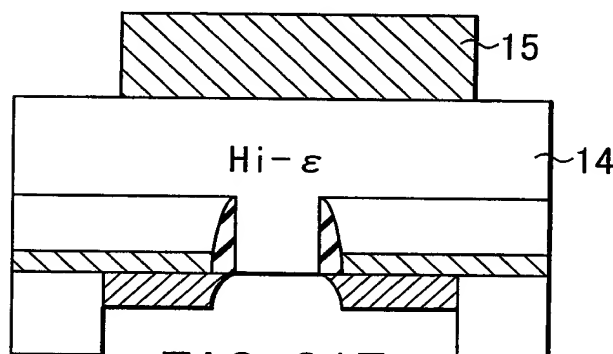


FIG. 31F

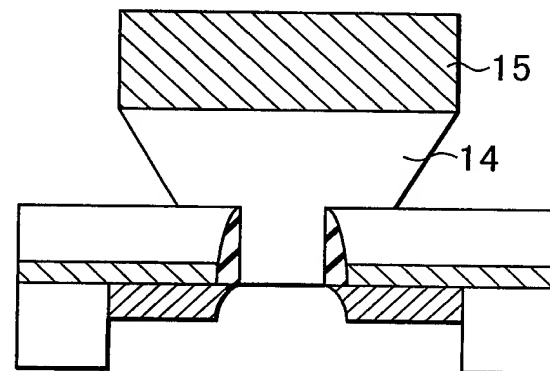


FIG. 31G

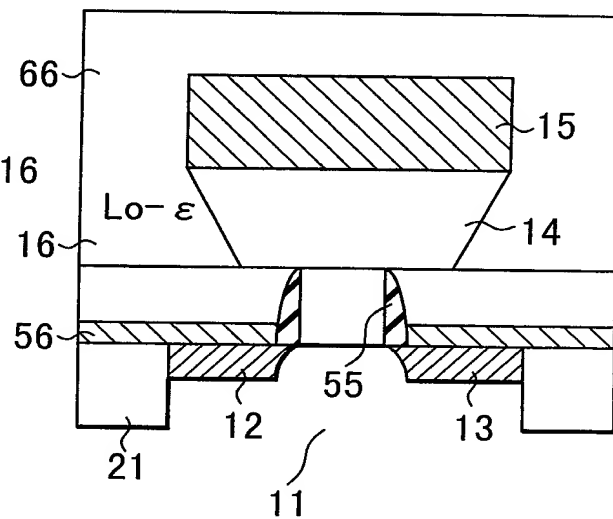


FIG. 31H

APPROVED	O.G. FIG.	
BY	CLASS	SUBCLASS
DRAFTSMAN		

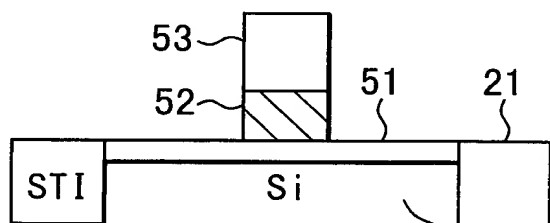


FIG. 32A

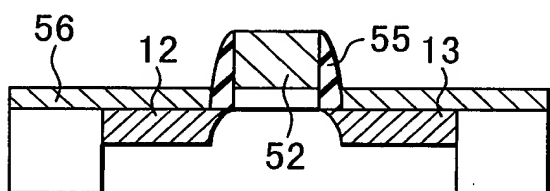


FIG. 32B

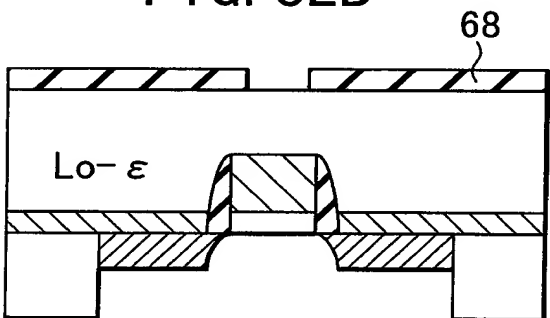


FIG. 32C

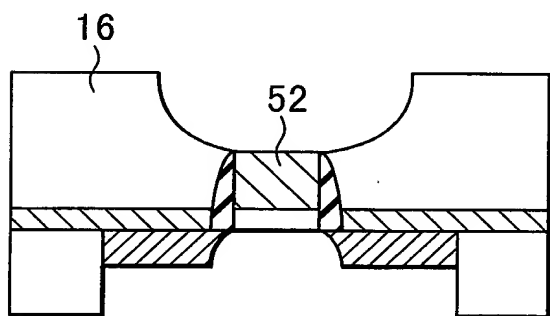


FIG. 32D

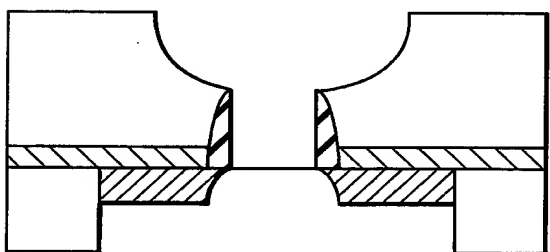


FIG. 32E

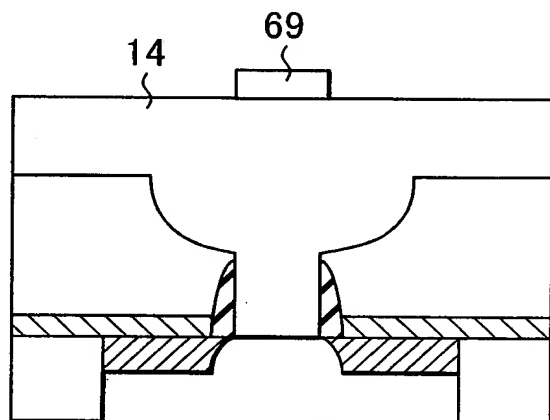


FIG. 32F

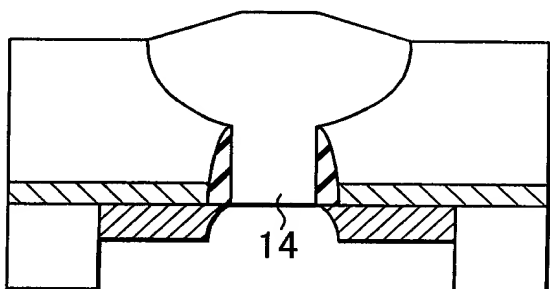


FIG. 32G

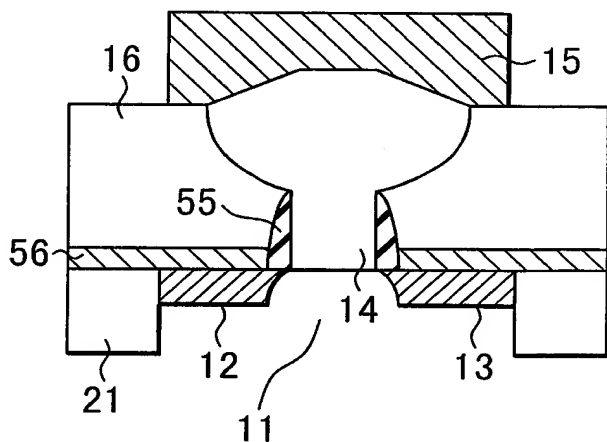


FIG. 32H

APPROVED	O.G. FIG.	
BY	CLASS	SUBCLASS
DESIGNER		

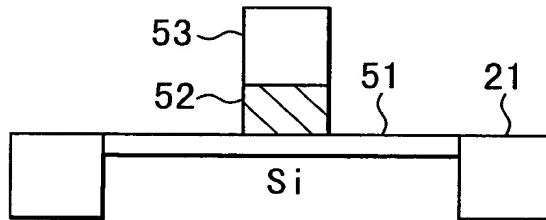


FIG. 33A

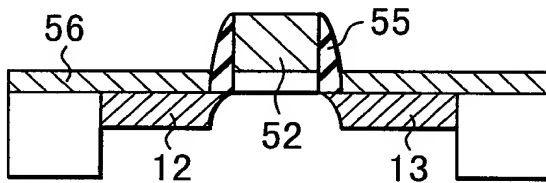


FIG. 33B

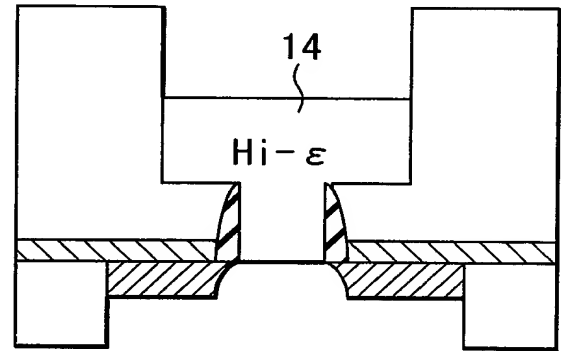


FIG. 33F

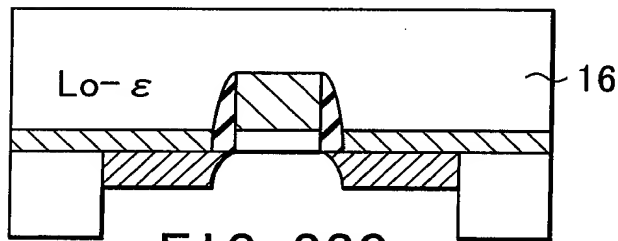


FIG. 33C

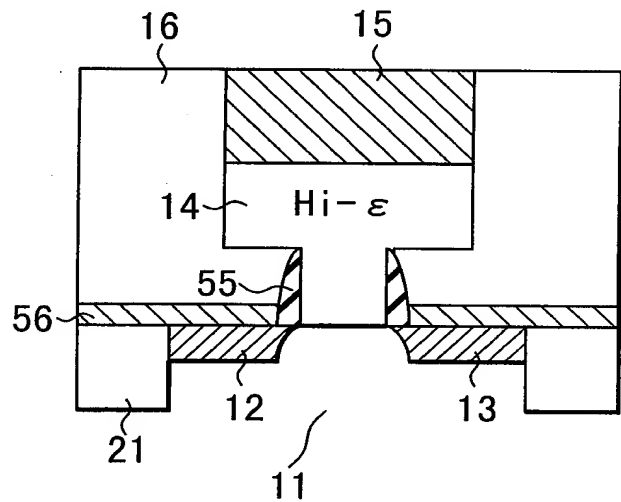


FIG. 33G

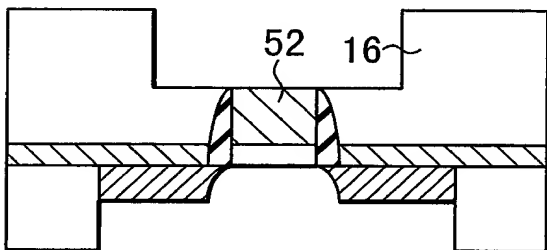


FIG. 33D

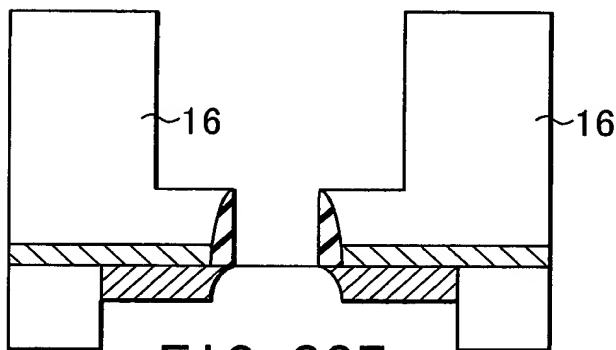


FIG. 33E



APPROVED	O.G. FIG.	
BY	CLASS	SUBCLASS
DRAFTSMAN		

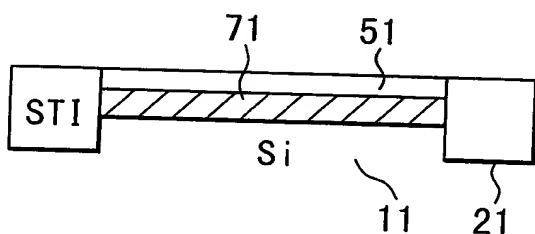


FIG. 34A

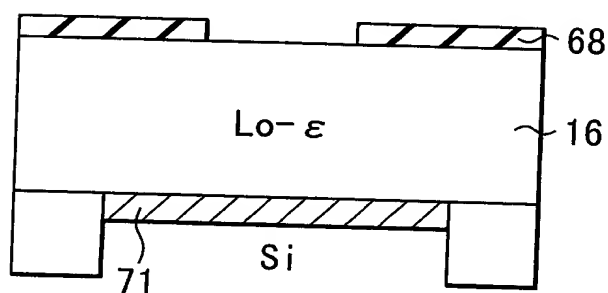


FIG. 34B

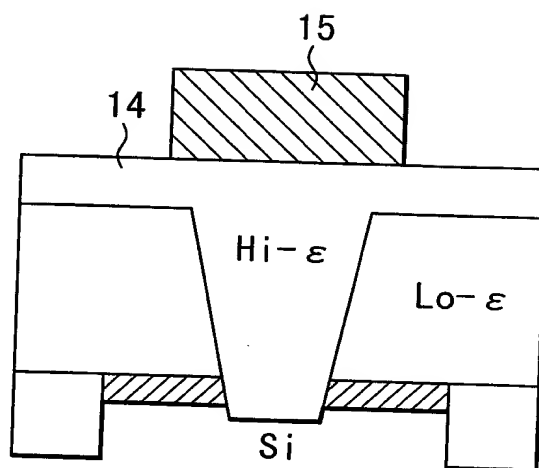


FIG. 34E

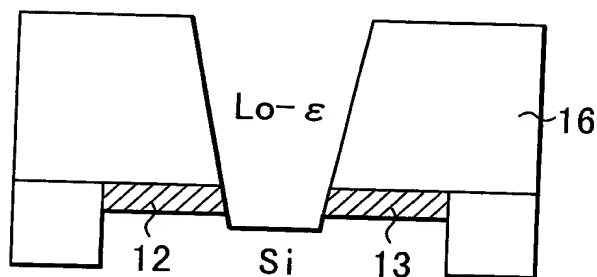


FIG. 34C

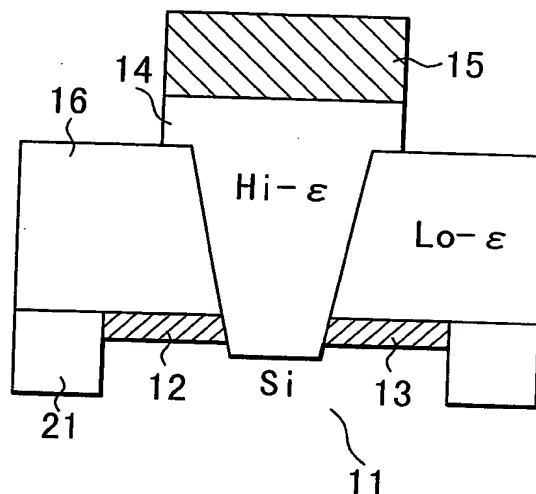


FIG. 34F

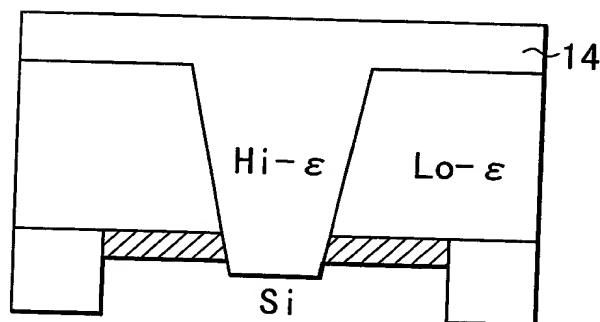


FIG. 34D

APPROVED	O.G. FIG.	
BY	CLASS	SUBCLASS
DRAFTSMAN		

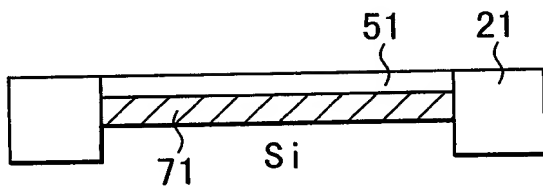


FIG. 35A

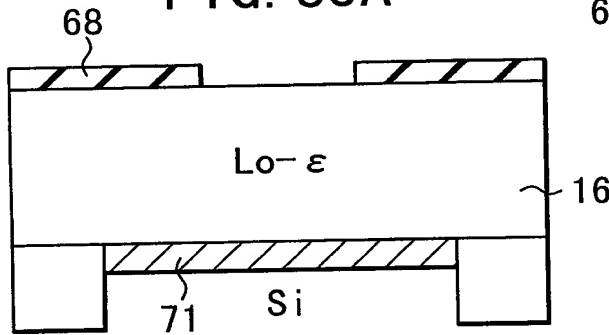


FIG. 35B

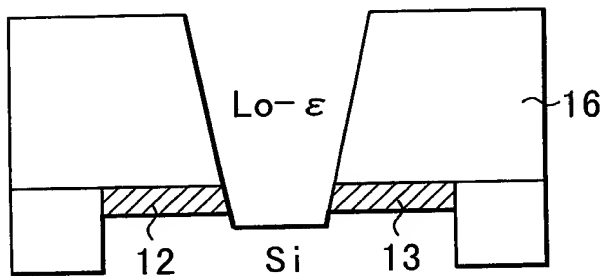


FIG. 35C

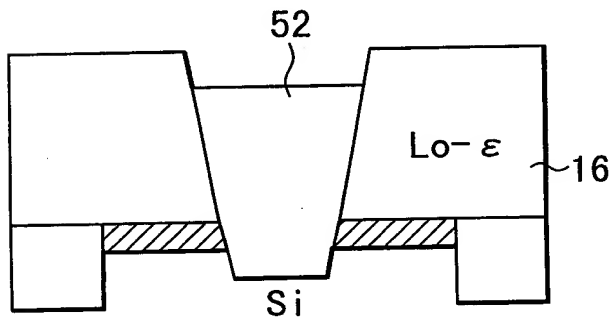


FIG. 35D

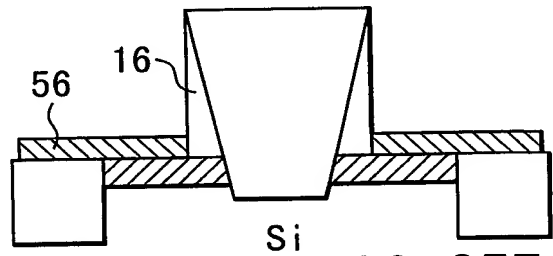


FIG. 35E

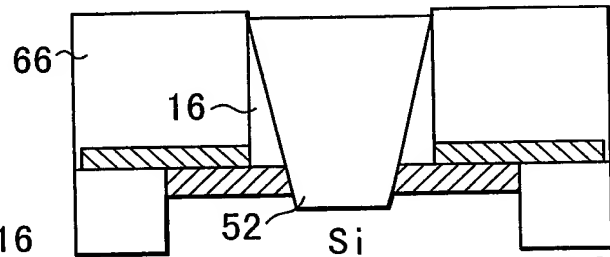


FIG. 35F

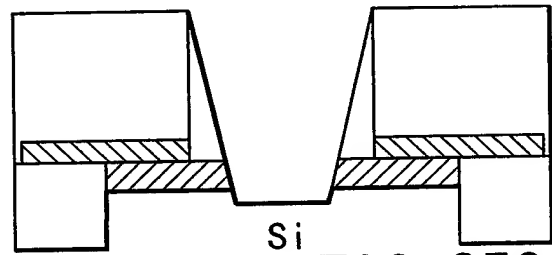


FIG. 35G

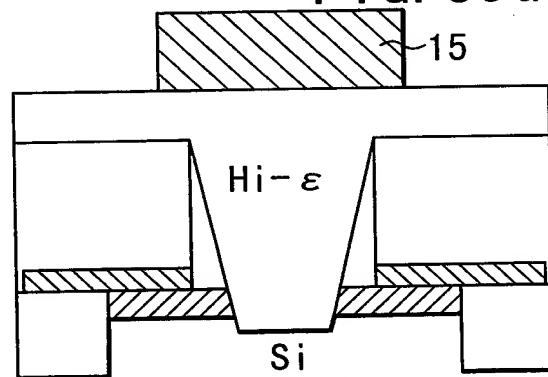


FIG. 35H

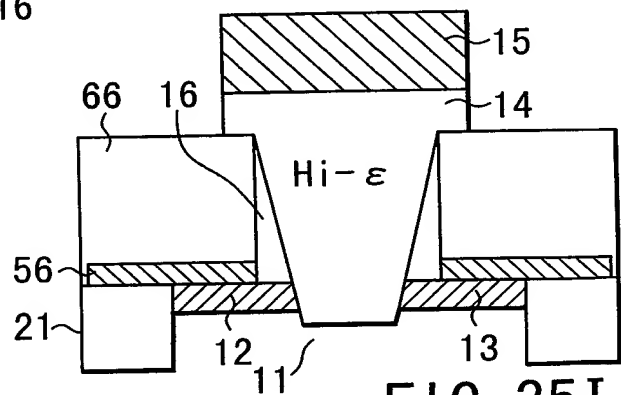


FIG. 35I